This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

HARVARD UNIVERSITY

LIBRARY OF THE
MINERALOGICAL
LABORATORY

UNIVERSITY MUSEUM

Water-Supply and Irrigation Paper No. 201 Series P, Hydrographic Progress Reports, 55

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

SURFACE WATER SUPPLY OF NEW ENGLAND, 1906

(ATLANTIC COAST OF NEW ENGLAND DRAINAGE)

H. K. BARROWS
DISTRICT HYDROGRAPHER

WASHINGTON
GOVERNMENT PRINTING OFFICE
1907

CONTENTS.

	Page.
Introduction	7
Scope of work	7
Definitions	9
Explanation and use of tables	10
Convenient equivalents	12
Field methods of measuring stream flow	13
Office methods of computing run-off	19
Cooperation and acknowledgments	22
Atlantic coast of New England drainage	22
St. John River drainage basin	22
Description of basin	22
St. John River at Fort Kent, Me	23
Fish River at Wallagrass, Me	25
Aroostook River at Fort Fairfield, Me	27
St. Croix River drainage basin	29
Description of basin	29
St. Croix River near Woodland, Me	29
Machias River drainage basin	32
Description of basin	32
Machias River near Whitneyville, Me	32
Penobscot River drainage basin	34
Description of basin	34
River surveys in Penobscot drainage	34
Penobscot River at Millinocket, Me	34
Penobscot River at West Enfield, Me	35
East Branch Penobscot River at Grindstone, Me	38
Mattawamkeag River at Mattawamkeag, Me	39
Piscataquis River near Foxcroft, Me	41
Cold Stream at Enfield, Me	42
Phillips Lake and outlets in Holden and Dedham, Me	44
Kennebec River drainage basin	48
Description of basin	48
River surveys in Kennebec drainage	49
Moosehead Lake at east outlet	49
Kennebec River at The Forks, Me	51
Kennebec River near North Anson, Me	52
Kennebec River at Waterville, Me	55
Kennebec River at Bingham, Me	57
Moose River near Rockwood, Me	57
Roach River at Roach River, Me	59
Dead River near The Forks, Me	60
Carrabassett River at North Anson, Me	62
Sandy River near Madison, Me	63
Cobbosseecontee Stream at Gardiner, Me	64

Atlantic coast of New England drainage—Continued. Page.
Androscoggin River drainage basin 66
Description of basin 66
River surveys in Androscoggin drainage 67
Androscoggin River at Shelburne, N. H 67
Androscoggin River at Rumford Falls, Me 69
Androscoggin River at Dixfield, Me 70
Presumpscot River drainage basin 72
Description of basin 72
Presumpscot River at outlet of Sebago Lake, Maine 72
Saco River drainage basin 74
Description of basin 74
Saco River near Center Conway, N. H 74
Merrimac River drainage basin 76
Description of basin 76
Merrimac River at Franklin Junction, N. H 76
Merrimac River at Garvins Falls, N. H 78
Merrimac River at Lawrence, Mass 80
Pemigewasset River at Plymouth, N. H 82
Contoocook River at West Hopkinton, N. H 84
Sudbury River at Framingham and Lake Cochituate at Cochituate, Mass 86
South Branch Nashua River at Clinton, Mass 87
Blackstone River drainage basin 88
Blackstone River near Womsocket, R. I 88
Connecticut River drainage basin 88
Description of basin 88
Connecticut River near Orford, N. H 89
Connecticut River at Sunderland, Mass 91
Connecticut River at Hartford, Conn 93
Israel River (above South Branch) near Jefferson Highlands, N. H 94
Israel River (below South Branch) near Jefferson Highlands, N. H 95
Ammonoosuc River at Bretton Woods, N. H 97
Zealand River near Twin Mountain, N. H 99
Deerfield River at Deerfield, Mass 101
Deerfield River at Hoosac Tunnel, Mass 102
Ware River near Ware, Mass 102
Ware River at Barre Plains, Mass 104
Quaboag River at West Warren, Mass 104
Quaboag River at Palmer, Mass 105
Westfield Little River near Blandford, Mass 105
Salmon River at Leesville, Conn 110
Ashuelot River at Hinsdale, N. H 112
Farmington River at Farmington, Conn 112
Housatonic River drainage basin 112
Description of basin 112
Housatonic River at Gaylordsville, Conn 112

ILLUSTRATIONS.

		Page
PLATE I.	Map of United States showing location of principal river stations maintained during 1906	8
II.	*A*, Current-meter rating station, Los Angeles, Cal.; *B*, Price current meters	16
III.	*A*, Plant of St. Croix Paper Company at Spragues Falls, Me.; *B*, Saco River below Salmon Falls dam, Me	28
IV.	Upper and lower dams of Androscoggin River at Rumford Falls, Me	68
V.	Great Falls of Saco River at Hiram, Me	74
FIG. 1.	Cable station, showing section of river, car, gage, etc	17
2.	Typical discharge, area, and mean velocity curves for Potomac River at Point of Rocks, Md	20

SURFACE WATER SUPPLY OF NEW ENGLAND, 1906.[a]

H. K. Barrows,
District hydrographer.[b]

INTRODUCTION.

SCOPE OF WORK.

The water supply of the United States is of more importance to the life and pursuits of the people than any other natural resource. In the arid States the limit of agricultural development is determined by the amount of water available for irrigation, while in all parts of the country the increase in the population of cities and towns makes necessary additional water supplies for domestic and industrial uses, in procuring which both the quantity and the quality of the water that may be obtained must be considered. The location of manufacturing plants may depend largely on the water-power facilities and on the character of the water. The notable advances made in the electric transmission of power have led to the utilization of water powers for the operation of manufacturing establishments, railroads, and municipal lighting plants, many of which are at some distance from the places at which the power is developed.

The intelligent establishment and maintenance of enterprises or industries that depend on the use of water demands a thorough knowledge of the flow of the streams and an understanding of the conditions affecting that flow. This knowledge should be based on data showing both the total flow and the distribution of the flow throughout the year, in order that normal fluctuations may be provided for As the flow of a stream is variable from year to year, estimates of future flow can be made only from a study of observations covering several years. The rapid increase in the development of the water

[a] This report contains information similar to that published in previous years under title "Report on the Progress of Stream Measurements."

[b] The data were collected under the direction of H. K. Barrows, assisted by T. W. Norcross, A. D. Butterfield, G. M. Brett, R. A. Mention, and F. E. Pressey.

The data were prepared for publication under the direction of John C. Hoyt, assisted by R. H. Bolster, Robert Follansbee, J. E. Stewart, F. F. Henshaw, and H. D. Padgett.

resources of the United States has caused a great demand by engir for information in regard to the flow of streams, as it is now gene: realized that the failure of many large power, irrigation, and c projects has been due to the fact that the plans were made wit: sufficient trustworthy information in respect to the water supply

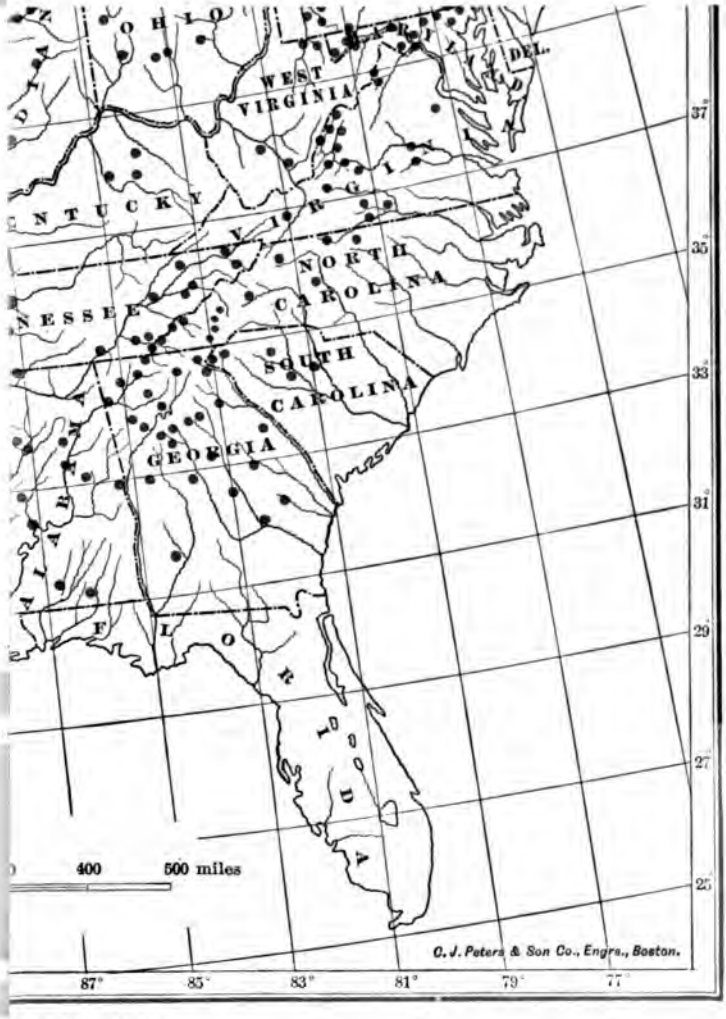
Owing to the broad scope of these hydrographic investigations the length of time they should cover in order that the records ma of greatest value, it is in general impossible for private individua collect the necessary data, and as many of the streams traverse r than one State this work does not properly fall within the provin the State authorities. The United States Geological Survey therefore, by means of specific appropriations by Congress, for sev years systematically made records of stream flow, with the vie ultimately determining all the important features governing the : of the principal streams of the country. In carrying out this stations are established on the streams and maintained for a pe long enough to show their regimen or general behavior. Whe record that is sufficient for this purpose has been obtained for stream, the work on that stream is discontinued. The orde which the streams are measured is determined by the degree of t importance.

During 1906 the regimen of flow was studied at about 700 stati distributed along the various rivers throughout the United States shown on Pl. I. In addition to these records data in regard to cipitation, evaporation, water power, and river profiles were obtai in many sections of the country.

These data have been assembled by drainage areas and are p lished in a series of fourteen Water-Supply and Irrigation Pap Nos. 201 to 214, inclusive, each of which pertains to the surface wa resources of a group of adjacent areas. In these papers are embodi not only the data collected in the field, but also the results of com tations based on these data and other information that has a dir bearing on the subject, such as descriptions of basins and the strea draining them, utility of the water resources, etc. The list follows.

Water-Supply and Irrigation Papers on surface water supply, 1906.

201. Surface water supply of New England, 1906. (Atlantic coast of New Engla drainage.)
202. Surface water supply of the Hudson, Passaic, Raritan, and Delaware river dra ages, 1906.
203. Surface water supply of the Middle Atlantic States, 1906. (Susquehanna, Gu powder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages.)
204. Surface water supply of the Southern Atlantic and Eastern Gulf States, 190 (Santee, Savannah, Ogeechee, and Altamaha rivers, and eastern Gulf of Mex drainages.)
205. Surface water supply of the Ohio and lower eastern Mississippi river drainag 1906.


WEST VIRGINIA
DEL.
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
400
500 miles
C. J. Peters & Son Co., Engrs., Boston.
37°
35°
33°
31°
29°
27°
25°
87°
85°
83°
81°
79°
77°

DURING 1906.

resources of the United States has caused a great demand by en for information in regard to the flow of streams, as it is now ge realized that the failure of many large power, irrigation, anc projects has been due to the fact that the plans were made w sufficient trustworthy information in respect to the water sup

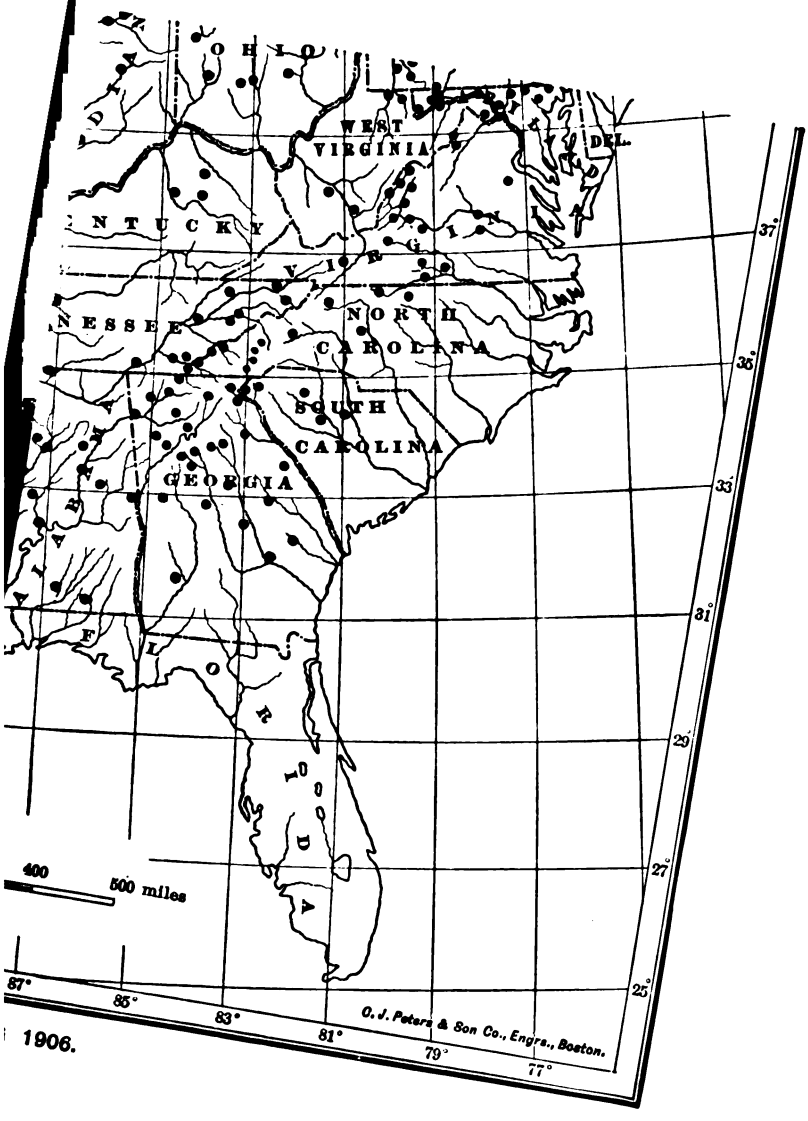
Owing to the broad scope of these hydrographic investigatio the length of time they should cover in order that the records n of greatest value, it is in general impossible for private individ collect the necessary data, and as many of the streams traverse than one State this work does not properly fall within the provi the State authorities. The United States Geological Surve therefore, by means of specific appropriations by Congress, for s years systematically made records of stream flow, with the vi ultimately determining all the important features governing th of the principal streams of the country. In carrying out this stations are established on the streams and maintained for a p long enough to show their regimen or general behavior. Wh record that is sufficient for this purpose has been obtained for stream, the work on that stream is discontinued. The ord which the streams are measured is determined by the degree of importance.

During 1906 the regimen of flow was studied at about 700 stat distributed along the various rivers throughout the United State shown on Pl. I. In addition to these records data in regard to cipitation, evaporation, water power, and river profiles were obtai in many sections of the country.

These data have been assembled by drainage areas and are p lished in a series of fourteen Water-Supply and Irrigation Pap Nos. 201 to 214, inclusive, each of which pertains to the surface wa resources of a group of adjacent areas. In these papers are embod not only the data collected in the field, but also the results of com tations based on these data and other information that has a dir bearing on the subject, such as descriptions of basins and the strea draining them, utility of the water resources, etc. The list follows.

Water-Supply and Irrigation Papers on surface water supply, 1906.

201. Surface water supply of New England, 1906. (Atlantic coast of New Engla drainage.)
202. Surface water supply of the Hudson, Passaic, Raritan, and Delaware river drai ages, 1906.
203. Surface water supply of the Middle Atlantic States, 1906. (Susquehanna, Gu powder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages.)
204. Surface water supply of the Southern Atlantic and Eastern Gulf States, 190 (Santee, Savannah, Ogeechee, and Altamaha rivers, and eastern Gulf of Mexic drainages.)
205. Surface water supply of the Ohio and lower eastern Mississippi river drainage 1906.


OHIO
WEST VIRGINIA
DEL.
NTUCKY
VIRGINIA
NESSEE
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
FLORIDA
400
500 miles
37°
35°
33°
31°
29°
27°
25°
87°
85°
83°
81°
79°
77°
O. J. Peters & Son Co., Engrs., Boston.

1906.

206. Surface water supply of the Great Lakes and St. Lawrence River drainages, 1906.
207. Surface water supply of the upper Mississippi River and Hudson Bay drainages, 1906.
208. Surface water supply of the Missouri River drainage, 1906.
209. Surface water supply of the lower western Mississippi River drainage, 1906.
210. Surface water supply of the western Gulf of Mexico and Rio Grande drainages, 1906.
211. Surface water supply of the Colorado River drainage above Yuma, 1906.
212. Surface water supply of the Great Basin drainage, 1906.
213. Surface water supply of California, 1906. (The Great Basin and Pacific Ocean drainages in California and Colorado River drainage below Yuma.)
214. Surface water supply of the North Pacific Coast drainage, 1906.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing such records up to and including 1903 has been published in Water-Supply Paper No. 119. The following table gives, by years and primary drainage basins, the numbers of the papers on surface water supply published from 1901 to 1906:

Numbers of Water-Supply Papers containing results of stream measurements, 1901-1906.[a]

	1901.	1902.	1903.	1904.	1905.	1906.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
Atlantic coast of New England drainage	65 75	82	97	124	165	201
Hudson, Passaic, Raritan, and Delaware river drainages	65 75	82	97	125	166	202
Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages	65 75	82 83	97 98	126	167	203
Santee, Savannah, Ogeechee, and Altamaha rivers and eastern Gulf of Mexico drainages	65 75	83	98	127	168	204
Ohio and lower eastern Mississippi river drainages	65 75	83	98	128	169	205
Great Lakes and St. Lawrence River drainages	65	83	97	129	170	206
Hudson Bay and upper eastern and western Mississippi River drainages	65 66 75	83 84 85	98 99 100	128 130	171	207
Missouri River drainage	66 75	84	99	130 151	172	208
Meramec, Arkansas, Red, and lower western Mississippi river drainages	66 75	84	99	131	173	209
Western Gulf of Mexico and Rio Grande drainages	66 75	84	99	132	174	210
Colorado River drainage, above Yuma	66 75	85	100	133	175	211
The Great Basin drainage	66 75	85	100	133	176	212
The Great Basin and Pacific Ocean drainages in California, and Colorado River drainage, below Yuma	66 75	85	100	134	177	213
North Pacific Coast drainage	66 75	85	100	135	178	214

[a] Reports containing data for years prior to 1901 are noted in the series list at the end of this paper.

DEFINITIONS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet per square mile, and (2) those which represent the actual quantity of water,

as run-off in depth in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the quantity of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the quantity of water that passes through an orifice 1 inch square under a head which varies locally. It has been commonly used by miners and irrigators throughout the West and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

"Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work. There is a convenient relation between the second-foot and the acre-foot: One second-foot flowing for twenty-four hours will deliver 86,400 cubic feet, or approximately 2 acre-feet.

EXPLANATION AND USE OF TABLES.

For each regular gaging station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of monthly and yearly discharges and run-off.
6. Tables showing discharge and horsepower and the number of days during the year when the same are available.

The descriptions of stations give such general information about the locality and equipment as would enable the reader to find and use the station, and they also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, name of the

hydrographer, width and area of cross section, gage height, and discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. At most stations the gage is read in the morning and in the evening.

The discharge measurements and gage heights are the base data from which the other tables are computed. In cases of extensive development it is expected that engineers will use these original data in making their calculations, as the computations made by the Survey are based on the data available at the time they are made and should be reviewed and, if necessary, revised when additional data are available.

The rating table gives the discharge in second-feet corresponding to various stages of the river as given by the gage heights. It is published to enable engineers to determine the daily discharge in case this information is desired.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow for each second during the month. Upon this the computations for the remaining columns, which are defined on page 10, are based.

The values in the table of monthly discharge are intended to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates.

In most work where data in regard to flow are used the regimen of flow is of primary importance. Therefore for the principal stations tables have been prepared showing the horsepower that can be developed at various rates of flow, and the length of time that these rates of flow and the corresponding horsepower are available. These tables have been prepared on a basis of 80 per cent efficiency on the turbines, and the horsepower per foot of fall is given in order that the reader can determine the horsepower for any fall.

In the computations sufficient significant figures have been used so that the percentage of error in the tables will not in general exceed 1 per cent. Therefore, most of the values in the tables are given to only three significant figures. In making the various computations Thatcher's slide rule, Crelle's tables, and computation machines have been generally used.

In order to give engineers an idea of the relative value of the various data notes in regard to accuracy are given as far as possible. This accuracy depends on the general local conditions at the gaging stations and the amount of data collected. Every effort possible is made to so locate the stations that the data collected will give a high degree of accuracy. This is not always possible, but it is considered better to publish rough values with explanatory notes rather than no data.

In the accuracy notes the following terms have been used, indicating the probable accuracy, in per cent, of the mean monthly flow. As these values are mean values, the error in the value for the flow of any individual day may be much larger.

Excellent indicates that the mean monthly flow is probably accurate to within 5 per cent; good, to within 10 per cent; fair, to within 15 per cent; approximate, to within 25 per cent.

CONVENIENT EQUIVALENTS.

Following is a table of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equal 18.7 United States gallons per second.
100 California miner's inches equal 96.0 Colorado miner's inches.
100 California miner's inches for one day equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 104 California miner's inches.
100 Colorado miner's inches for one day equal 5.17 acre-feet.
100 United States gallons per minute equal 0.223 second-feet.
100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.

1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1½ horsepower equal about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel, realizing 80 per cent of theoretical power.

FIELD METHODS OF MEASURING STREAM FLOW.

The methods used in collecting these data and in preparing them for publication are given in detail in Water-Supply Papers No. 94 (Hydrographic Manual, U. S. Geol. Survey) and No. 95 (Accuracy of Stream Measurements). In order that those who use this report may readily become acquainted with the general methods employed, the following brief descriptions are given:

Streams may be divided, with respect to their physical conditions, into three classes: (1) Those with permanent beds; (2) those with beds which change only during extreme low or high water; and (3) those with constantly shifting beds. In determining the daily flow special methods are necessary for each class. The data on which the determinations are based and the methods of collecting them are, however, in general the same.

There are three distinct methods of determining the flow of open-channel streams: (1) By measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir, (3) by measurements of the velocity of the current and of the area of the cross section. The method chosen for any case depends on the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to the coefficients to be used in the Chezy formula, $v = c\sqrt{Rs}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The

results obtained by the slope method are in general only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for n to be used in Kutter's formula. The most common use of this method is in estimating the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions.

Weir method.—When funds are available and the conditions are such that sharp-crested weirs can be erected, these offer the best facilities for determining flow. If dams are suitably situated and constructed, they may be utilized for obtaining reliable measurements of flow. The conditions necessary to insure good results may be divided into two classes: (1) Those relating to the physical characteristics of the dam itself, and (2) those relating to the diversion and use of water around and through the dam.

The physical requirements are as follows: (*a*) Sufficient height of dam, so that backwater will not interfere with free fall over it; (*b*) absence of leaks of appreciable magnitude; (*c*) topography or abutments which confine the flow over the dam at high stages; (*d*) level crests which are kept free from obstructions caused by floating logs or ice; (*e*) crests of a type for which the coefficients to be used in $Q = c\ b\ h^{\frac{3}{2}}$, or some similar standard weir formula, are known (see Water-Supply Papers Nos. 180 and 200[a]); (*f*) either no flashboards or exceptional care in reducing leakage through them and in recording their condition.

Preferably there should be no diversion of water through or around the dam. Generally, however, the dam is built for purposes of power or navigation, and part or all of the water flowing past it is diverted for such uses. This water is measured and added to that passing over the dam. To insure accuracy in such determinations of flow, the amount of water diverted should be reasonably constant. Furthermore, it should be so diverted that it can be measured, either by a weir, a current meter, or a simple system of water wheels which are of standard make, or which have been rated as meters under working conditions and so installed that the gate openings, the heads under which they work, and their angular velocities may be accurately observed.

The combination of physical conditions and uses of the water should be such that the determinations of flow will not involve, for a critical stage of considerable duration, the use of a head on a broad-crested dam of less than 6 inches. Moreover, when all other conditions are good, the cooperation of the owners or operators of the plant is still essential if reliable results are to be obtained.

[a] Water-Supply Paper No. 200 replaces No. 150, the edition of which has been exhausted.

A gaging station at a weir or dam has the general advantage of continuity of record through the period of ice and floods and the disadvantages of uncertainty of coefficient to be used in the weir formula and of complications in the diversion and use of the water.

Velocity method.—The determination of the quantity of water flowing past a certain section of a stream at a given time is termed a discharge measurement. This quantity is the product of two factors—the mean velocity and the area of the cross section. The mean velocity is a function of surface slope, wetted perimeter, roughness of bed, and the channel conditions at, above, and below the gaging section. The area depends on the contour of the bed and the fluctuations of the water surface. The two principal ways of measuring the velocity of a stream are by floats and current meters.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements, in order that the data may have the required degree of accuracy. Their essential requirements are practically the same, whether the velocity is determined by meters or floats. They are located, as far as possible, where the channel is straight both above and below the gaging section; where there are no cross currents, backwater, or boils; where the bed of the stream is reasonably free from large projections of a permanent character, and where the banks are high and subject to overflow only at flood stages. The station must be so far removed from the effects of tributary streams and of dams or other artificial obstructions that the gage height shall be an index of the discharge.

Certain permanent or semipermanent structures, usually referred to as "equipment," are generally pertinent to a gaging station. These are a gage for determining the fluctuations of the water surface, bench marks to which the datum of the gage is referred, permanent marks on a bridge or a tagged line indicating the points of measurement, and, where the current is swift, some appliance (generally a secondary cable) to hold the meter in position in the water. As a rule the stations are located at bridges if the channel conditions are satisfactory, as from them the observations can more readily be made and the cost of the equipment is small.

The floats in common use are the surface, subsurface, and tube or rod floats. A corked bottle with a flag in the top and weighted at the bottom makes one of the most satisfactory surface floats, as it is affected but little by wind. In case of flood measurements good results can be obtained by observing the velocity of floating cakes of ice or débris. In case of all surface-float measurements coefficients must be used to reduce the observed velocity to the mean velocity. The subsurface and tube or rod floats are intended to give directly the mean velocity in the vertical. Tubes give excellent results when the channel conditions are good, as in canals.

In measuring velocity by a float, observation is made of the time taken by the float to pass over the "run," a selected stretch of river from 50 to 200 feet long. In each discharge measurement a large number of velocity determinations are made at different points across the stream, and from these observations the mean velocity for the whole section is determined. This may be done by plotting the mean positions of the floats, as indicated by the distances from the bank, as ordinates and the corresponding times as abscissas. A curve through these points shows the mean time of run at any point across the stream, and the mean time for the whole stream is obtained by dividing the area bounded by this curve and its axis by the width. The length of the run divided by the mean time gives the mean velocity.

The area used in float measurements is the mean of the areas at the two ends of the run and at several intermediate sections.

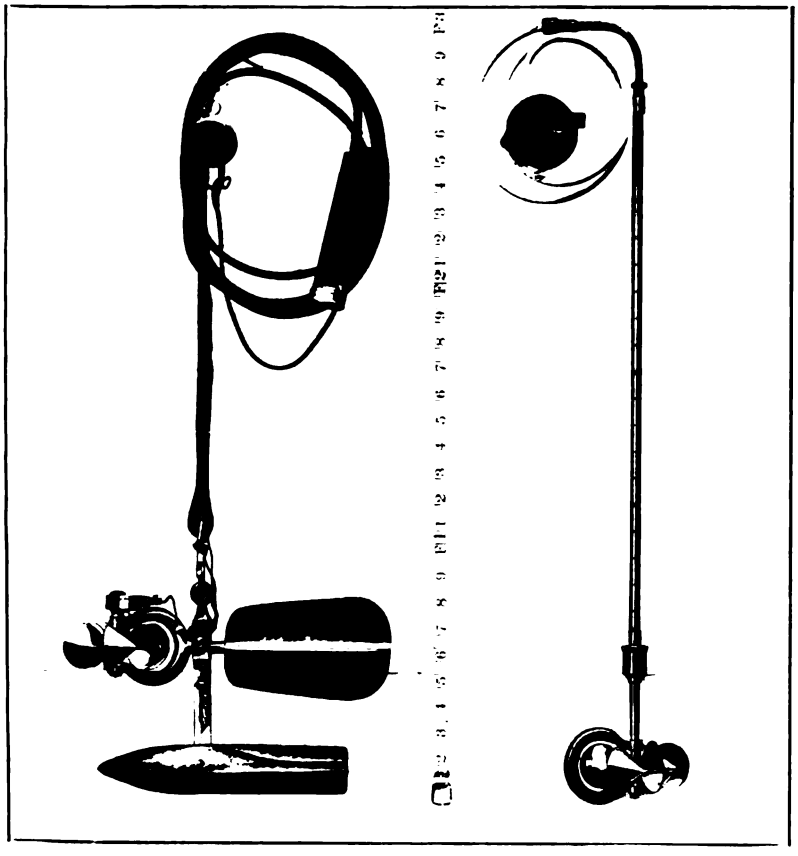
The essential parts of the current meters in use are a wheel of some type, so constructed that the impact of flowing water causes it to revolve, and a device for recording or indicating the number of revolutions. The relation between the velocity of the moving water and the revolutions of the wheel is determined for each meter. This rating is done by drawing the meter through still water for a given distance at different speeds and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity per second for any number of revolutions.

Many kinds of current meters have been constructed. They may, however, be classed in two general types—those in which the wheel is made up of a series of cups, as the Price, and those having a screw-propeller wheel, as the Haskell. Each meter has been developed for use under some special condition. In the case of the small Price meter, shown in Pl. II, *B*, which has been largely developed and extensively used by the United States Geological Survey, an attempt has been made to get an instrument which could be used under practically all conditions.

Current-meter measurements may be made from a bridge, cable, boat, or by wading, and gaging stations may be classified in accordance with such use. Fig. 1 shows a typical cable station.

In making the measurement an arbitrary number of points are laid off on a line perpendicular to the thread of the stream. The points at which the velocity and depth are observed are known as measuring points, and are usually fixed at regular intervals, varying from 2 to 20 feet, depending on the size and condition of the stream. Perpendiculars dropped from the measuring points divide the gaging section into strips. For each strip or pair of strips the mean velocity, area, and discharge are determined independently, so that conditions existing

A. CURRENT-METER RATING STATION AT LOS ANGELES, CAL.



B. PRICE CURRENT METERS.

in one part of the stream may not be extended to parts where they do not apply.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

The three principal multiple-point methods in general use are the vertical velocity-curve; 0.2 and 0.8 depth; and top, bottom, and mid-depth.

In the vertical velocity-curve method a series of velocity determinations are made in each vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve among the resulting points, the vertical velocity-curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity-curve and its axis by the depth. On account of the length of time required to

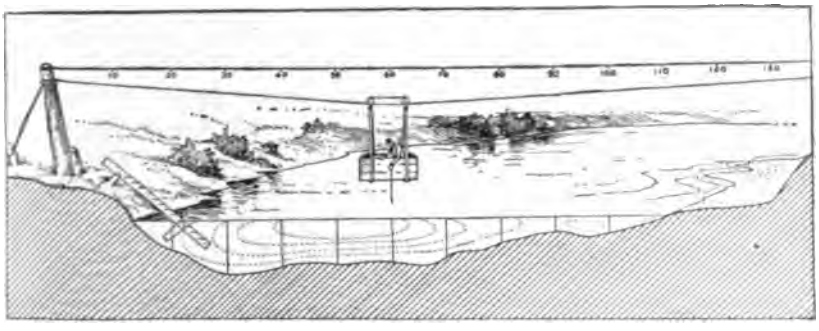


FIG. 1.—Cable station, showing section of river, car, gage, etc.

make a complete measurement by this method, its use is limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 of the depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity-curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 of the depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this second multiple-point method gives the mean velocity very closely for open-water conditions, and moreover the indications are that it holds nearly as well for ice-covered rivers.

In the third multiple-point method the meter is held at mid-depth, at 0.5 foot below the surface, and at 0.5 foot above the bottom, and the mean velocity is determined by dividing by 6 the sum of the top

velocity, four times the mid-depth velocity, and the bottom velocity. This method may be modified by observing at 0.2, 0.6, and 0.8 depth.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity, or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined.

Extensive experiments by vertical velocity-curves show that the thread of mean velocity generally occurs at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, at which point the meter is held in a majority of the measurements. A large number of vertical velocity-curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be from 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is specially adapted for flood measurements, or when the velocity is so great that the meter can not be kept at 0.6 depth.

The vertical-integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface, and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods.

The area, which is the other factor in the velocity method of determining the discharge of a stream, depends on the stage of the river, which is observed on the gage, and on the general contour of the bed of the stream, which is determined by soundings. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable or by a special sounding line or rod. For streams with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also of value in obtaining the area for use in computations of high-water measurements, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at various points of measurement, the measuring section is divided into elementary strips, as shown in fig. 1, and the mean velocity, area, and discharge are determined separately for either

a single or a double strip. The total discharge and the area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8, and vertical velocity-curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, the thickness and character of the ice, etc.

From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice. For information in regard to flow under ice cover see Water-Supply Paper No. 187.

OFFICE METHODS OF COMPUTING RUN-OFF.

There are two principal methods of determining run-off, depending on whether or not the bed of the stream is permanent.

For stations on streams with permanent beds the first step in computing the run-off is the construction of a rating table, which shows the discharge corresponding to any stage of the stream. This rating table is applied to the record of stage to determine the amount of water flowing. The construction of the rating table depends on the method used in measuring flow.

For a station at a weir or dam the basis for the rating table is some standard weir formula. The coefficients to be used in its application depend on the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and the assumed coefficient the discharge is computed for various heads and the rating table constructed.

The data necessary for the construction of a rating table for a velocity-area station are the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross section, the mean velocity of the current, and the quantity of water flowing. A thorough knowledge of the conditions at and in the vicinity of the station is also necessary.

The construction of the rating table depends on the following laws of flow for open, permanent channels: (1) The discharge will remain constant so long as conditions at or near the gaging station remain constant; (2) the discharge will be the same whenever the stream is at a given stage if the change of slope due to the rise and fall of the stream be neglected; (3) the discharge is a function of and increases gradually with the stage.

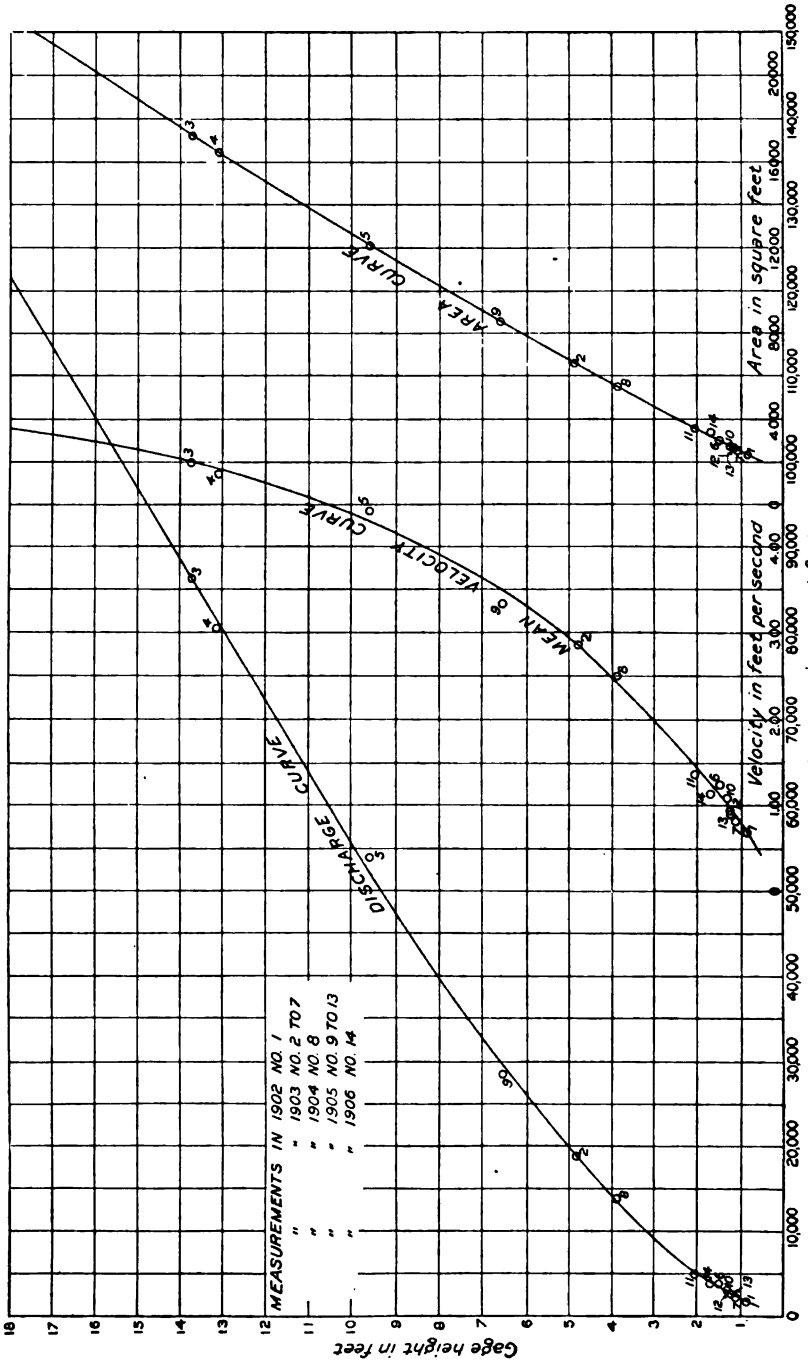


FIG. 2.—Discharge, area, and mean-velocity curves for Potomac River at Point of Rocks, Md.

The plotting of results of the various discharge measurements, using gage heights as ordinates, and discharge, mean velocity, and area as abscissas, will define curves which show the discharge, mean velocity, and area corresponding to any gage height. For the development of these curves there should be, therefore, a sufficient number of discharge measurements to cover the range of the stage of the stream. Fig. 2 shows a typical rating curve with its corresponding mean-velocity and area curves.

As the discharge is the product of two factors, the area and the mean velocity, any change in either factor will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is always concave toward the horizontal axis or on a straight line, unless the banks of the stream are overhanging.

The form of the mean-velocity curve depends chiefly on the surface slope, the roughness of the bed, and the cross section of the stream. Of these, the slope is the principal factor. In accordance with the relative changes of these factors the curve may be either a straight line, convex or concave toward either axis, or a combination of the three. From a careful study of the conditions at any gaging station the form which the vertical velocity-curve will take can be predicted, and it may be extended with reasonable certainty to stages beyond the limits of actual measurements. Its principal use is in connection with the area curve in locating errors in discharge measurements and in constructing the rating table.

The discharge curve is defined primarily by the measurements of discharge, which are studied and weighted in accordance with the local conditions existing at the time of each measurement. The curve may, however, best be located between and beyond the measurements by means of curves of area and mean velocity. The discharge curve under normal conditions is concave toward the horizontal axis and is generally parabolic in form.

In the preparation of the rating table the discharge for each tenth or half tenth on the gage is taken from the curve. The differences between successive discharges are then taken and adjusted according to the law that they shall either be constant or increasing.

The determination of daily discharge of streams with changeable beds is a difficult problem. In case there is a weir or dam available, a condition which seldom exists on streams of this class, the discharge can be determined by its use. In case of velocity-area stations frequent discharge measurements must be made if the determinations of flow are to be other than rough approximations. For stations with beds which shift slowly or are materially changed only during floods

rating tables can be prepared for periods between such changes and satisfactory results obtained with a limited number of measurements, provided that some of them are taken soon after the change occurs. For streams with continually shifting beds, such as the Colorado and Rio Grande, discharge measurements should be made every two or three days and the discharges for intervening days obtained either by interpolation modified by gage height or by Professor Stout's method, which has been described in full in the Nineteenth Annual Report of the United States Geological Survey, Part IV, page 323, and in the Engineering News of April 21, 1904. This method, or a graphical application of it, is also much used in determining the flow at stations where the bed shifts but slowly.

COOPERATION AND ACKNOWLEDGMENTS.

Assistance has been rendered or records furnished by the following, to whom special acknowledgment is due:

Maine State survey commission, L. A. Lee, chairman, C. S. Hichborn, secretary and treasurer, and William Engel; Bangor and Aroostook Railroad; Maine Central Railroad; Washington County Railroad; Portland and Rumford Falls Railroad; Montpelier and Wells River Railroad; H. S. Ferguson, engineer of Great Northern Paper Company; H. C. Lord; F. E. Boston, agent, and James L. Dean, engineer, for the Hollingsworth & Whitney Company; Joseph A. Warren, of S. D. Warren & Co.; C. A. Mixer, engineer for the Rumford Falls Power Company; Walter H. Sawyer, agent Union Water Power Company, Lewiston, Me.; J. Brodie Smith, manager of Manchester Traction Light and Power Company; R. A. Hale, principal assistant engineer Essex Company, Lawrence, Mass.; Frederic P. Stearns, chief engineer of the Metropolitan water and sewerage board; Otis Company and George H. Gilbert Manufacturing Company, Ware, Mass.; John T. F. MacDonnell, Holyoke, Mass.; E. E. Lochridge, engineer for the Springfield water department.

ATLANTIC COAST OF NEW ENGLAND DRAINAGE.

ST. JOHN RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

St. John River drains the largest basin between St. Lawrence River on the north and Susquehanna River on the south. Its total drainage area is stated by Wells[a] to be 26,000 square miles, of which approximately 7,500 square miles lie in Maine, its basin occupying the whole northern portion of the State. The extreme headwaters lie in the mountainous region between Maine and Canada, at elevations of 1,500 and 2,000 feet; thence its waters flow at first generally north-

[a] Wells, Walter. The water power of Maine. 1869.

eastward through Maine. From the point of junction of the northwest and southwest branches, where the river first takes its name, to its junction with St. Francis River, a distance of 90 miles, its course lies wholly in Maine, though a portion of the tributary area lies in Canada. In this distance Allegash River is the only tributary of importance. Wells estimates the average slope in the 90 miles to be 1.6 feet per mile. From its junction with St. Francis River the St. John forms the northern boundary of Maine for 70 miles. Within this distance the slope is slightly greater than above, having been estimated at 2.7 feet per mile, while the volume is considerably augmented by two important tributaries—Fish River from the south and Madawaska River from the north. At the point where it leaves the State line the river has an elevation of about 420 feet above sea level and drains an area of 8,765 square miles, of which 4,670 square miles are in Maine and 4,095 square miles in Canada. Beyond this point it receives the waters of Aroostook and Meduxnekeag rivers, the basins of which are almost entirely in Maine, besides several smaller tributaries having their sources, and in some cases a large portion of their drainage basins in the same State.

Both the Allegash and upper St. John rivers are generally inaccessible. The middle St. John, forming the northern boundary of the State, may be reached on the Canadian side at any point by the Temiscouata Railway, and on the Maine side at Fort Kent and Van Buren by the Bangor and Aroostook Railroad. The basins of Fish and Aroostook rivers are easily accessible by the latter road. The drainage areas of the principal tributaries are given in Water-Supply Paper No. 165, page 20.

ST. JOHN RIVER AT FORT KENT, ME.

This station was established October 13, 1905. It is located at the footbridge which crosses the St. John near Fort Kent post-office, a short distance above the point where Fish River enters the St. John. The conditions at this station and the bench marks are described in Water-Supply Paper No. 165, page 21.

Discharge measurements of St. John River at Fort Kent, Me., 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905. October 13 [a]	F. E. Pressey	230	385	2.55	660
1906. May 29	F. E. Pressey	656	3,910	8.25	17,400
August 15	do	431	735	3.20	1,420

[a] Measured partly from a boat and partly by wading.

Daily gage height, in feet, of St. John River at Fort Kent, Me., for 1905–6.

Day.	1905.		1906.						
	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Oct.	Nov.
1		3.35		9.95	6.45	4.8	2.9		3.6
2		3.9		10.6	6.45	4.8	2.9		3.5
3		4.1		10.95	6.15	4.75	2.8		3.5
4		4.55		11.55	5.9	4.7	2.8		3.5
5		5.15		11.85	5.75	4.7	2.8		3.5
6		4.9		12.6	5.55	4.6	2.8		3.5
7		4.9		12.9	5.45	4.6	2.8		3.5
8				13.25	5.0	4.6	2.8		3.5
9				13.3	5.0	4.5	2.8		3.5
10				12.9	5.0	4.5	2.95		3.5
11				12.35	5.0	4.4	3.15		3.5
12				11.8	4.9	4.3	3.25		3.5
13	2.6			11.3	4.9	4.2	3.3		3.5
14	2.7			10.6	4.8	4.2	3.15		3.5
15	2.6			9.9	4.8	4.1	2.95		3.5
16	2.65			9.3	4.7	4.0	2.8		3.5
17	2.6			9.1	4.7	4.0			3.35
18	2.6			9.0	4.7	4.0			3.45
19	2.6			9.0	4.6	4.0			3.5
20	2.45			8.9	4.5	3.9			3.65
21	2.8		8.9	8.85	4.45	3.8		3.2	3.85
22	3.35		8.8	8.45	4.5	3.7		3.65	4.4
23	4.35		8.75	7.9	4.5	3.6		3.95	4.3
24	4.0		9.05	7.45	4.75	3.5		4.3	4.3
25	3.8		9.4	6.95	5.3	3.4		4.5	4.3
26	3.65		9.9	6.85	6.15	3.3		4.25	
27	3.4		10.35	6.7	6.85	3.2		3.95	
28	3.05		10.65	6.6	7.3	3.2		3.55	
29	3.1		10.4	6.5	7.95	3.1		3.55	
30	2.95		10.1	6.5	7.95	3.0		3.4	
31	2.8			6.5		3.0		3.55	

NOTE.—From August 16 to October 20, 1906, inclusive, gage readings were reported at 2.8 feet, but during much of the time were probably below this, as gage could not be read.

Rating table for St. John River at Fort Kent, Me., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	550	3.90	2,680	5.40	6,620	7.80	15,430
2.50	630	4.00	2,890	5.50	6,930	8.00	16,250
2.60	710	4.10	3,110	5.60	7,250	8.20	17,090
2.70	800	4.20	3,340	5.70	7,580	8.40	17,930
2.80	900	4.30	3,580	5.80	7,910	8.60	18,780
2.90	1,010	4.40	3,830	5.90	8,250	8.80	19,660
3.00	1,130	4.50	4,090	6.00	8,590	9.00	20,500
3.10	1,270	4.60	4,350	6.20	9,280	10.00	24,950
3.20	1,420	4.70	4,610	6.40	10,000	11.00	29,550
3.30	1,580	4.80	4,880	6.60	10,730	12.00	34,250
3.40	1,740	4.90	5,150	6.80	11,470	13.00	39,050
3.50	1,910	5.00	5,430	7.00	12,220	13.3	40,520
3.60	2,090	5.10	5,720	7.20	13,000		
3.70	2,280	5.20	6,010	7.40	13,800		
3.80	2,480	5.30	6,310	7.60	14,610		

NOTE.—The above table is applicable only for open-channel conditions. It is based on three discharge measurements made during 1905–6. This curve should be fairly accurate, but is subject to revision later when more data become available.

Monthly discharge of St. John River at Fort Kent, Me., for 1905–6.

[Drainage area, 5,280 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
October (13–31)	3,700	590	1,350	0.256	0.18
November (1–7)	5,860	1,660	3,980	.754	.20
1906.					
April (21–30)	27,900	19,400	23,300	4.41	1.64
May	40,500	10,400	24,000	4.55	5.25
June	16,000	3,960	7,090	1.34	1.50
July	4,880	1,130	3,060	.580	.67
August (1–16)	1,580	900	1,070	.203	.12
October (21–31)	4,090	1,420	2,550	.483	.20
November (1–25)	3,830	1,660	2,220	.421	.39

NOTE.—The above values are only approximate, owing to errors in gage-height observations.

FISH RIVER AT WALLAGRASS, ME.

This station was established July 29, 1903. It is located at Wallagrass, Me., just below the outlet of Wallagrass Brook. The conditions at this station and the bench marks are described in Water-Supply Paper No. 165, page 21, where are given also references to publications that contain data for previous years.

Discharge measurements of Fish River at Wallagrass, Me., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.[a]	Gage height.[b]	Thickness of ice.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Feet.*	*Feet.*	*Sec.-ft.*
February 15	F. E. Pressey	95	205	3.91	3.91	1.25	196
March 15	do	115	312	4.99	5.03	1.20	378
March 15	do	115	319	5.08	5.12	1.20	390
May 30	do	168	1,210	9.30			4,250
August 15	do	106	240	2.50			175

[a] To water surface. [b] To top of ice.

Daily gage height, in feet, of Fish River at Wallagrass, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					8.8		5.8	3.1	2.2	1.9		4.2
2			4.3		9.3	8.6					4.8	
3						8.2	5.3	3.0	2.1	1.9	4.7	4.5
4					10.2			3.0		1.8		
5				3.2	11.2	7.6	5.0		2.1		4.7	4.5
6	2.9							2.9	2.1	1.8		
7				3.2	12.0	7.3	4.9	2.9			4.5	4.5
8			4.3	3.2	13.0				2.1	1.8		4.4
9		3.5				7.0	4.7	2.8	2.1	1.8	4.9	
10				3.2	13.6	7.0					5.0	5.2
11	3.1						4.5	2.8	2.1	3.0		
12				3.2	13.7	7.0					4.8	4.9
13							4.4	2.7	2.1	2.9		
14		3.9	5.1	3.3	13.5	7.0	4.3				4.6	4.8
15				3.5			4.2	2.5	2.1	2.0		4.8
16					13.2	6.3		2.5	2.0	3.2	4.5	
17				3.7	13.2		4.0			3.5	4.4	4.5
18						6.0		2.4	2.0			
19				4.2	13.0		3.9			3.7	4.4	
20	3.0	3.8		4.7		6.6		2.4	2.0	3.7		

Daily gage height, in feet, of Fish River at Wallagrass, Me., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21				5.3	12.7		3.8	2.4			4.3	
22					12.3	4.7			1.9	3.8		
23			5.2	5.5		4.6	3.7	2.4			4.2	4.6
24	3.3				11.0		3.7		1.9	3.9	4.1	
25				6.0		6.0		2.4				
26				6.8	10.8	6.0	3.6	2.3	2.0	4.7	4.4	4.8
27				7.2	10.5					4.5		
28			4.6	7.5		6.0	3.3	2.3	2.0		4.4	
29					9.4				2.0	4.5		
30	3.4			8.4		5.9	3.2	2.2			4.3	
31					8.8					4.7		

NOTE.—The following ice conditions prevailed during 1906: River frozen from January 1 to about April 20; ice began to wear away about March 25; there was no ice near gage or measuring section after April 5. There was ice along both shores during December, but river did not freeze entirely across. During the frozen period gage heights were taken to water surface, through a hole in the ice. The following comparative readings were taken:

Comparative ice and water readings.

Date.	Water surface.	Top of ice.	Thickness of ice.	Date.	Water surface.	Top of ice.	Thickness of ice.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*	*Feet.*
January 6[a]	2.9	3.0	0.1	March 2	4.3	4.3	1.15
January 11[a]	3.1	3.0	.7	March 8	4.3	4.2	.85
January 20[a]	3.0	3.1	.8	March 14	5.1	5.2	1.25
January 24[a]	3.3	3.4	.1	March 23	5.2	5.2	1.3
January 30	3.4	3.4	.65	March 28[a]	4.6	4.6	.1
February 9	3.5	3.6	.9	December 17[a]	4.5	5.0	.8
February 14	3.9	3.9	1.25	December 23[a]	4.6	4.7	.7
February 20	3.8	3.9	1.35	December 26[a]	4.8	4.9	1.3

[a] Open channel in midstream; thickness of ice given is at gage, near shore.

Rating table for Fish River at Wallagrass, Me.

OPEN-CHANNEL CONDITIONS, 1903 TO 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	59	3.20	366	4.60	888	7.00	2,200
1.90	72	3.30	397	4.70	932	7.20	2,331
2.00	86	3.40	429	4.80	977	7.40	2,464
2.10	102	3.50	462	4.90	1,023	7.60	2,599
2.20	120	3.60	496	5.00	1,070	7.80	2,738
2.30	139	3.70	531	5.20	1,167	8.00	2,880
2.40	159	3.80	567	5.40	1,268	9.00	3,650
2.50	180	3.90	604	5.60	1,372	10.00	4,520
2.60	203	4.00	642	5.80	1,479	11.00	5,490
2.70	227	4.10	681	6.00	1,590	12.00	6,550
2.80	252	4.20	721	6.20	1,705	13.00	7,650
2.90	279	4.30	762	6.40	1,824	14.00	8,850
3.00	307	4.40	803	6.60	1,946		
3.10	336	4.50	845	6.80	2,071		

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1906, and is well defined.

FROZEN SEASON, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.30	140	2.90	230	3.50	320	4.10	425
2.50	170	3.10	260	3.70	355	4.30	460
2.70	200	3.30	290	3.90	390	4.50	495

[a] This table is applicable only for ice-covered conditions using gage heights to bottom of ice. It is based on 4 discharge measurements made during 1906, and is fairly well defined between gage heights 2.5 feet and 4 feet.

Monthly discharge of Fish River at Wallagrass, Me., for 1906.

[Drainage area, 890 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January			193	0.217	0.25
February			202	.227	.24
March			380	.427	.49
April	3,170	305	953	1.07	1.19
May	8,490	3,490	6,330	7.11	8.20
June	3,410	888	2,010	2.26	2.52
July	1,480	351	753	.846	.98
August	336	120	206	.231	.27
September	120	72	92.8	.104	.12
October	932	59	419	.471	.54
November	1,070	681	800	.966	1.08
December			561	.630	.73
The year			1,080	1.21	16.61

NOTE.—Values are rated as follows: January to March and December, fair; September, good; remainder of year excellent.

AROOSTOOK RIVER AT FORT FAIRFIELD, ME.

This station was established July 31, 1903. It is located at the steel highway bridge in the village of Fort Fairfield. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 24, where are given also references to publications that contain data for previous years.

A measurement was made August 17, 1906, by F. E. Pressey, with the following results:

Width, 269 feet; area, 515 square feet; gage height, 3.44 feet; discharge, 488 second-feet.

Daily gage height, in feet, of Aroostook River at Fort Fairfield, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.6				11.9	6.75	4.95	4.35	3.25	3.3	4.6	4.4
2					12.3	6.6	4.7	4.05	3.2	3.35	4.6	4.4
3					12.65	6.8	4.55	3.85	3.2	3.4	4.5	4.4
4				5.4	12.15	7.4	4.2	3.7	3.25	3.4	4.5	4.95
5					12.5	7.85	4.05	3.8	3.2	3.3	4.5	5.75
6	3.6				12.85	7.35	4.2	3.9	3.1	3.35	4.4	6.6
7					13.35	6.9	4.1	3.9	3.15	3.35	4.4	
8					13.3	6.6	4.05	3.9	3.1	3.4	4.4	
9					13.05	6.4	4.1	3.8	3.1	3.35		
10		4.6			12.4	6.45	4.0	3.7	3.2	3.5	4.4	
11			4.75		12.3	6.3	4.15	3.75	3.2	7.45		
12					12.0	5.95	4.3	3.85	3.3	9.25		
13	3.6			5.7	12.45	5.9	4.05	3.7	3.25	8.4		
14					11.7	5.15	3.95	3.75	3.3	8.45	4.4	
15					11.35	4.35	4.0	3.65	3.25	7.45		
16					11.0	4.4	3.9	3.7	3.2	6.15		
17		4.5			10.55	4.55	4.05	3.5	3.2	5.85	4.6	
18			4.8	8.5	10.45	4.35	4.2	3.45	3.2	5.7		
19				9.7	10.65	4.2	4.65	3.4	3.2	5.5	4.5	
20	3.9			9.1	10.9	4.2	4.9	3.35	3.25	5.0	4.5	
21				8.75	10.85	4.15	5.2	3.3	3.25	4.8	4.4	
22				9.45	9.75	4.3	5.0	3.35	3.2	4.7	4.4	
23	4.2			10.15	8.8	4.35	4.95	3.4	3.2	4.7	4.5	5.0
24				10.75	8.2	4.9	4.85	3.2	3.2	4.65	4.4	
25		4.5	4.75	9.9	7.8	5.2	4.5	3.3	3.3	4.65	4.4	

Daily gage height, in feet, of Aroostook River at Fort Fairfield, Me., for 1906—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26				10.4	7.65	5.5	4.2	3.25	3.3	4.6	4.3	.....
27				11.05	7.75	5.35	4.05	3.3	3.25	4.65	4.4	.....
28				11.2	7.45	5.35	4.0	3.4	3.3	4.5	4.4	.....
29				10.95	7.1	5.45	4.15	3.4	3.2	4.6	4.4	.....
30				11.35	7.05	5.0	4.2	3.4	3.25	4.6	4.4	5.1
31	4.6			.....	6.5	.....	4.4	3.4	.....	4.6	.....	.....

NOTE.—The following ice conditions prevailed during 1906: River frozen January 1 to April 17, inclusive, and December 6 to 31, inclusive; ice began to go out April 18. During the frozen period gage heights were taken to water surface through a hole in the ice. The following comparative readings were taken:

Comparative ice and water readings.

Date.	Water surface.	Top of ice.	Thickness of ice.	Date.	Water surface.	Top of ice.	Thickness of ice.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*	*Feet.*
January 1	3.6	3.6	1.0	February 25	4.5	4.6	1.9
January 6	3.6	3.6	1.1	March 11	4.75	4.8	1.9
January 13	3.6	3.6	1.1	March 18	4.8	4.8	1.9
January 20[a]	3.9	3.9	1.6	March 25	4.75	4.8	1.9
January 23[a]	4.2	4.1	1.6	April 4	5.4	5.6	1.8
January 31	4.6	4.6	1.7	April 13	5.7	5.9	1.8
February 10	4.6	4.7	1.9	December 23	5.0	5.1	0.8
February 17	4.5	4.6	1.9	December 30	5.1	5.1	1.1

[a] Water above top of ice.

Rating table for Aroostook River at Fort Fairfield, Me., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.10	180	4.40	1,664	5.70	4,019	8.00	9,500
3.20	240	4.50	1,822	5.80	4,222	8.20	10,100
3.30	310	4.60	1,984	5.90	4,427	8.40	10,710
3.40	390	4.70	2,150	6.00	4,635	8.60	11,330
3.50	480	4.80	2,320	6.20	5,060	8.80	11,960
3.60	580	4.90	2,494	6.40	5,495	9.00	12,600
3.70	690	5.00	2,672	6.60	5,940	10.00	15,910
3.80	810	5.10	2,854	6.80	6,395	11.00	19,400
3.90	940	5.20	3,040	7.00	6,865	12.00	23,000
4.00	1,075	5.30	3,230	7.20	7,345	13.00	26,700
4.10	1,215	5.40	3,423	7.40	7,840		
4.20	1,360	5.50	3,619	7.60	8,360		
4.30	1,510	5.60	3,818	7.80	8,910		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-1906, and is well defined.

Monthly discharge of Aroostook River at Fort Fairfield, Me., for 1906.

[Drainage area, 2,230 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April (18-30)	20,700	11,000	16,300	7.31	3.53
May	28,000	5,720	18,400	8.25	9.51
June	9,060	1,290	4,000	1.79	2.00
July	3,040	940	1,600	.718	.83
August	1,590	240	620	.278	.32
September	310	180	254	.114	.13
October	13,400	310	3,120	1.40	1.61
November	1,980	1,510	1,740	.780	.87
December (1-6)	5,940	1,660	2,940	1.32	.29

NOTE.—The above values are excellent.

A. PLANT OF ST. CROIX PAPER COMPANY AT SPRAGUE'S FALLS, MAINE.

B. SACO RIVER BELOW SALMON FALLS DAM, MAINE.

ST. CROIX RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

St. Croix River is formed by two branches; one, known as the upper St. Croix or Chiputneticook River, is the outlet of Schoodic Lakes, the other, Kennebasis River, is the outlet of the western lakes of the area, known as Kennebasis Lakes. The upper St. Croix, with its tributary lakes, forms nearly half of the eastern boundary of Maine, separating that State from New Brunswick. The total drainage area of the main stream is about 1,630 square miles, of which 920 square miles are tributary to the great reservoir systems controlled by dams at Vanceboro and Princeton. The length of the stream from the headwaters to the mouth is 100 miles. The basin is, in general, lower than that of any of the larger streams of the State flowing into the Atlantic, its headwaters having an elevation of about 540 feet. The fall from Chiputneticook (the lower of the Schoodic Lakes) to tide water, a distance of 54 miles, is, however, 382 feet, or 7 feet to the mile. At a number of places, where falls and rapids occur, water power has been or can easily be developed.

The lake surface area of the upper St. Croix is approximately 50 square miles and that of West Branch 70 square miles, taking into account only the principal lakes and ponds. Indeed, above Vanceboro and Princeton, each branch of the river is simply a succession of lakes to almost the extreme headwaters. Wells estimated the total lake surface of the St. Croix as not less than 150 square miles, or nearly one-tenth of the total basin. The drainage area at various points on the river is given in Water-Supply Paper No. 165, page 27.

There are on this stream favorable locations for paper and pulp mills, and during 1905 the St. Croix Paper Company developed Spragues Falls with a 6,000-horsepower installation of wheels, to utilize a head of from 40 to 44 feet.

ST. CROIX RIVER NEAR WOODLAND, ME.

This station was established December 4, 1902, at a point a short distance above Spragues Falls, now called Woodland, near Baring; on June 8, 1905, it was moved about 1½ miles downstream to avoid backwater effects caused by the building of a paper mill and dam at Spragues Falls (see Pl. III, *A*). The conditions at the station and the bench marks are described in Water-Supply Paper No. 165, page 28, where are given also references to publications that contain data for previous years.

Discharge measurements of St. Croix River near Woodland, Me., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
June 14	F. E. Pressey	295	1,090	7.73	2,370
September 6	do	292	790	6.74	1,170
September 7	do	292	790	6.75	1,140
October 5	do	283	660	6.23	640
November 20[a]	do	288	785	6.69	995
1906.					
April 25	F. E. Pressey	315	1,920	10.46	7,620
April 25	do	315	1,930	10.50	7,790
May 25	do	311	1,460	8.75	3,370
August 27	do	298	1,080	7.60	1,650
November 7	do	296	1,010	7.56	1,980

[a] Anchor ice probably affected results.

Daily gage height, in feet, of St. Croix River near Woodland, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1			8.8			9.2		8.7	7.2	7.0	8.3	
2	8.5						7.6	8.7		7.1	8.3	7.3
3					10.2		7.5	8.6	7.2	7.1		7.3
4					10.2	9.2	7.5	8.5	7.1	7.0		7.3
5	8.7			6.1	10.1	9.2	7.5		7.4	7.0	8.7	7.3
6					10.1	9.3	7.4		7.2	6.9	8.4	7.3
7					10.0	9.4	7.4	8.4	7.2		7.8	
8	8.7	8.9	8.9		9.9	9.3		8.3	7.0	6.9	7.7	
9					9.8	9.2	7.7	8.2		7.0	7.7	
10					9.7		7.9	8.1	7.0	7.2	7.7	
11					9.6	9.1	8.0		7.0	7.4		
12	8.7			7.9	9.4	9.0	8.1		7.1	7.5	7.7	7.7
13						8.8	8.2	8.0	7.1	7.5	7.7	7.7
14					9.1	8.7	8.2	7.9	7.1		7.4	7.7
15					8.8	8.7		7.9	7.1	7.6	7.5	7.7
16			8.6		8.7	8.6	8.3	7.8		7.7	7.7	
17		9.4			8.7		8.4	7.8	7.0	7.8	7.8	7.5
18				10.2	8.6	8.5	8.4	7.8	7.0	7.9		
19	9.4	9.4				8.2	8.5		6.9	7.9	7.8	
20						8.0	8.5		6.9	7.9	7.8	7.7
21					8.5	7.8		7.6	7.1		7.8	7.7
22			9.4		8.5	7.7		7.5		8.0	7.7	7.6
23		9.4		10.4	8.5		8.4	7.4		8.1	7.6	
24				10.4	8.4		8.4	7.45	7.3	8.1		
25					8.4	7.7	8.4	7.4	7.4	8.2		7.5
26	12.9			10.6	8.4	7.6	8.4		7.5	8.2	6.6	7.6
27				10.6		7.6	8.3		7.6	8.2	7.0	
28			9.3		9.0	7.6	8.3	7.3	6.4		7.3	7.7
29					9.6	7.7		7.2	6.4	8.2	7.5	
30					9.6	7.8	8.5	7.2		8.3	7.5	
31	10.0				9.4		8.6	7.2		8.3		

NOTE.—The following ice conditions prevailed during 1906: River frozen January 1-26; ice partly went out on the latter date; again frozen from about February 1 to April 15; river clear of ice April 26. In December some ice formed near the gage, but the river did not freeze over. During the frozen period gage heights were taken to water surface through a hole in the ice.

The following comparative readings were taken:

Comparative ice and water readings.

Date.	Water surface.	Top of ice.	Thickness of ice.	Date.	Water surface.	Top of ice.	Thickness of ice.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*	*Feet.*
January 8	8.7	.....	1.8	March 1	8.8	8.9	1.55
January 19	9.4	.....	1.4	March 8	8.9	8.9	1.5
January 26[a]	12.9	.....	.....	March 16	8.6	9.4	1.6
January 31	10.0	.....	.6	March 22	9.4	9.4	1.6
February 9	8.9	8.9	1.3	March 28	9.3	9.3	1.6
February 17	9.4	9.4	1.6	April 5	6.1	.....	(b)
February 23	9.4	9.5	1.6				

[a] Ice all gone in midstream. [b] No ice at gage.

Rating table for St. Croix River near Woodland, Me., from July 1 to May 14, 1905, and October 26 to December 31, 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
6.00	480	7.00	1,360	8.00	2,660	9.00	4,390
6.10	545	7.10	1,470	8.10	2,810	9.20	4,790
6.20	615	7.20	1,590	8.20	2,970	9.40	5,210
6.30	690	7.30	1,710	8.30	3,130	9.60	5,640
6.40	770	7.40	1,830	8.40	3,300	9.80	6,090
6.50	860	7.50	1,960	8.50	3,470	10.00	6,550
6.60	950	7.60	2,090	8.60	3,650	10.20	7,020
6.70	1,050	7.70	2,230	8.70	3,830		
6.80	1,150	7.80	2,370	8.80	4,010		
6.90	1,250	7.90	2,510	8.90	4,200		

NOTE.—The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1905–6 and is fairly well defined between gage heights 6.2 feet and 11 feet. From about May 15 to about October 25, 1906, the flow was affected by backwater, the table has been applied during this period by taking the discharge as that given for a gage height 0.3 foot lower than the observed height.

Monthly discharge of St. Croix River near Woodland, Me., for 1905–6.

[Drainage area, 1,420 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
July	4,390	2,660	3,210	2.26	2.61
August	2,370	1,050	1,420	1.00	1.15
September	1,150	690	964	.679	.76
October	690	480	549	.387	.45
November	1,250	480	756	.532	.59
1906.					
May	7,020	2,810	4,670	3.29	3.79
June	4,590	1,710	3,090	2.18	2.43
July	3,130	1,470	2,410	1.70	1.96
August	3,300	1,250	2,100	1.48	1.71
September	1,710	545	1,150	.810	.90
October	3,130	950	2,020	1.42	1.64
November	3,830	950	2,310	1.63	1.82
December	2,230	1,710	2,040	1.44	1.66

NOTE.—Values for 1905 are rated as follows: October, good; remainder of 1905, excellent. Values for 1906 are rated as follows: All months good, except September and October, which are fair, owing to errors in gage height observations.

MACHIAS RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The Machias may be taken as fairly representative of several of the smaller streams of Maine which empty their waters directly into the ocean and which are commonly referred to as "coastal rivers." Its total drainage basin is 495 square miles, nearly all of which lies in Washington County, Me. Its extreme headwaters lie at an elevation of nearly 500 feet, and are not more than 50 miles from tide water. Wells listed 20 lakes in this basin, aggregating 29.5 square miles in area of water surface. Without important exception these lie, however, in the extreme headwaters. Dams are maintained at several of the outlets of the lakes, and the stored water is used for log driving.

MACHIAS RIVER NEAR WHITNEYVILLE, ME.

This station was established October 17, 1903, at the bridge of the Washington County Railway, near Whitneyville. The drainage area at this point is 465 square miles. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 30, where a given also references to publications that contain data for previ years. The original gage, of the standard chain type, was attache to the guard timber on the downstream side of the railroad bridge, but on October 3, 1905, a vertical wooden staff gage was placed on one of the piers of the wooden highway bridge, about one-half mile upstream from the railroad bridge, and all gage heights given below are by this new gage, which is read by Ira S. Albee. The bench mark is a marked point on an outcropping ledge 25 feet downstream from the bridge on the left bank; elevation, 15.54 feet; the reference point is a marked point on a timber behind the gage; elevation, 9.33 feet. Elevations refer to datum of gage. Measurements are made from the railroad bridge, as formerly.

Discharge measurements of Machias River near Whitneyville, Me., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 24	F. E. Pressey	124	1,050	7.01	2,7[illegible]
May 24	do	126	830	5.49	1,[illegible]
August 28	do	125	605	3.45	[illegible]
November 8	do	125	650	4.11	[illegible]

Daily gage height, in feet, of Machias River near Whitneyville, Me., for 1905.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	3.6	2.9	4.25	17	3.3	4.85	4.05
2	3.55	3.8	4.1	18	3.25	4.85	3.95
3	3.4	4.5	5.1	19	3.1	4.4	3.85
4	3.35	4.35	6.55	20	2.9	4.1	3.8
5	3.3	4.45	6.9	21	3.3	3.9	3.9
6	3.2	4.5	5.1	22	3.0	3.8	4.05
7	2.9	4.85	4.8	23	3.4	3.7	4.55
8	2.8	4.8	4.35	24	3.35	3.7	4.4
9	3.2	4.8	4.1	25	3.4	3.6	4.45
10	3.2	4.7	4.1	26	3.3	3.6	4.1
11	3.2	4.2	4.0	27	3.2	3.5	4.0
12	3.25	3.6	3.8	28	3.25	3.45	3.9
13	3.3	3.75	3.9	29	2.85	3.45	3.8
14	3.3	3.7	4.35	30	3.05	4.2	4.4
15	3.0	3.7	4.55	31	3.0	.....	.....
16	3.35	3.6	4.3				

Daily gage height, in feet, of Machias River near Whitneyville, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.8	4.6	4.5	6.8	7.7	7.8	5.8	4.2	3.2	3.0	3.7	4.1
2	4.4	4.6	4.4	6.0	7.7	7.4	5.3	4.0	3.2	3.0	4.0	4.2
3	4.4	4.6	4.3	5.4	7.6	7.6	4.8	3.7	3.2	3.0	5.0	4.4
4	4.5	4.4	6.7	5.2	7.4	7.5	4.8	3.7	3.2	2.9	5.2	4.2
.....	5.4	4.2	6.6	5.4	7.2	7.2	5.1	3.8	3.2	2.9	4.8	3.8
.....	5.4	4.1	5.7	5.9	7.2	7.1	5.3	3.6	3.2	2.5	4.4	3.8
.....	5.0	4.0	5.1	6.1	7.9	7.4	5.0	3.7	3.2	2.7	4.2	3.9
8	4.6	4.0	4.8	5.8	7.9	7.7	4.7	3.6	3.1	2.8	4.0	3.9
9	4.3	4.2	4.8	5.3	7.2	7.5	4.6	3.6	3.0	3.4	4.0	4.0
10	4.1	4.2	6.8	5.2	6.7	7.2	4.6	3.6	3.0	3.7	3.95	4.0
11	3.9	4.3	6.2	5.1	6.5	6.8	4.7	3.6	3.1	4.0	4.5	4.0
12	4.0	4.3	5.7	4.8	7.0	6.1	6.7	4.5	3.1	4.6	5.3	3.9
13	3.8	4.1	5.1	4.6	7.0	5.6	6.9	4.4	3.2	4.4	5.9	3.9
14	3.9	4.2	4.7	4.9	7.0	5.5	7.1	4.0	3.6	4.4	5.3	4.0
15	4.1	4.2	4.5	6.3	6.1	5.5	6.3	3.7	3.9	4.2	4.6	3.9
16	4.3	4.1	4.4	9.8	5.8	5.4	5.4	3.6	3.9	3.9	5.0	4.0
17	7.4	4.1	4.4	9.4	5.4	5.3	5.1	3.5	3.8	3.8	5.5	4.0
18	7.3	4.1	4.3	8.4	5.7	5.0	4.4	3.5	3.6	3.7	5.3	4.0
19	6.8	4.0	4.2	8.1	6.1	5.2	4.3	3.6	3.6	3.6	5.0	4.0
20	6.2	4.0	4.5	7.1	6.2	5.3	4.2	3.6	3.5	3.5	5.0	4.0
21	5.9	3.9	4.4	6.5	5.9	5.1	4.0	3.5	3.2	3.5	4.7	4.2
22	6.0	4.0	4.4	6.8	5.8	4.8	4.2	3.5	3.1	3.4	4.6	5.6
23	6.2	4.1	4.4	6.8	5.7	4.8	4.2	3.6	3.0	3.3	4.7	6.0
24	6.3	4.0	4.3	7.1	5.5	5.1	4.1	3.5	3.1	3.4	4.6	5.6
25	6.4	4.0	4.3	8.0	5.4	5.4	4.1	3.5	3.0	3.4	4.4	5.4
26	6.4	4.4	4.2	7.8	5.5	5.3	4.0	3.4	3.0	3.6	4.3	5.2
27	6.3	5.4	4.3	7.5	5.6	5.0	4.0	3.4	3.0	4.0	4.2	5.2
28	6.1	5.4	5.4	7.2	7.9	5.2	4.0	3.4	3.0	4.0	4.1	4.9
29	5.7	.....	6.4	7.2	9.5	5.3	3.9	3.4	3.0	3.8	4.0	4.8
30	5.3	.....	6.7	7.1	9.4	5.8	4.0	3.3	3.0	3.7	4.5	4.6
31	4.9	.....	6.8	.....	8.4	.....	4.1	3.2	.....	3.6	.....	4.4

NOTE.—The river does not usually freeze at or near the gage, and the flow is probably not greatly affected by ice conditions.

PENOBSCOT RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The Penobscot basin, which has a total area of about 8,500 square miles, lies wholly in Maine. It extends from the Atlantic Ocean on the south to the basin of the St. John on the north, a distance of 160 miles, and from the New Brunswick boundary on the east to the Quebec boundary on the west, a distance of 115 miles. The general elevation of the basin is lower than that of the drainage basins to the west. The headwaters of the main river lie in the mountainous region on the boundary of Quebec, at an elevation of nearly 2,000 feet. The slopes of the upper tributaries are generally steep. Chesuncook Lake lies near the center of the basin at an elevation of 930 feet. From this point to tide water the distance along the river is about 121 miles, indicating an average slope of 7.7 feet to the mile. This is concentrated at intervals by ledges where water power has been or may be developed. The water from about 800 square miles of the basin is discharged into the main river below its lowest available water power at Bangor. The drainage areas of the principal tributaries are given in Water-Supply Paper No. 165, page 33.

RIVER SURVEYS IN PENOBSCOT DRAINAGE.

In order to point out the power and storage possibilities in the Penobscot River drainage basin, surveys have been made as follows: From tide water to Seboomook Falls, near Northwest Carry, for the determination of the profile and plan of the river.

From the data collected sheets have been prepared showing, as far as available, profile of water surface, plan of the river, contours along the banks, and prominent natural or artificial features. The results of these surveys have been published on sheets and may be had on application to the Director of the Geological Survey.

PENOBSCOT RIVER AT MILLINOCKET, ME.

The discharge of Penobscot River at Millinocket has been computed and the data furnished by H. S. Ferguson, engineer for the Great Northern Paper Company. The conditions at the station and the bench marks are described in Water-Supply Paper No. 165, page 33, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Penobscot River at Millinocket, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	342	992	656	548	2,541	5,071	7,619	5,830	2,042	2,054	2,075	2,041
2	363	833	643	634	2,511	5,051	7,708	6,329	(a)	2,041	2,071	(a)
3	351	943	674	636	2,511	4,836	2,431	4,015	1,999	2,043	2,059	(a)
4	364	480	571	636	2,511	4,579	3,554	3,641	(a)	2,039	(a)	2,051
5	349	998	791	616	2,508	4,236	4,062	3,699	1,994	2,042	2,009	2,044
6	368	918	782	637	(a)	6,047	2,752	3,983	1,983	2,028	2,055	2,043
7	195	843	784	628	2,482	2,944	2,531	4,015	1,984	(a)	2,025	2,027
8	349	607	821	556	2,493	2,911	5,155	4,104	2,035	1,983	2,082	2,044
9	343	686	785	644	2,493	3,328	4,882	4,614	(a)	2,043	2,083	1,988
10	355	835	776	624	2,702	5,973	2,534	4,540	2,039	2,034	2,078	2,044
11	360	554	549	641	2,516	6,155	2,521	4,270	2,036	2,031	(a)	1,993
12	358	800	789	636	2,671	6,028	3,927	4,027	2,034	(a)	2,057	2,019
13	355	802	792	640	4,138	4,797	5,402	4,062	2,039	2,042	2,075	2,030
14	259	763	704	637	5,422	2,753	4,588	3,334	2,055	(a)	2,074	2,025
15	374	634	551	520	9,400	3,510	2,893	2,575	2,032	2,038	2,075	2,022
16	373	645	795	1,122	15,769	6,551	2,479	2,575	2,030	2,040	2,074	(a)
17	374	791	618	1,061	17,972	3,667	2,504	2,575	2,041	2,030	2,062	2,032
18	363	516	634	1,030	18,635	3,737	2,502	2,575	2,039	2,045	(a)	2,032
19	357	811	802	1,198	18,110	4,781	2,492	2,618	2,035	2,042	2,050	2,030
20	363	640	801	1,202	15,819	4,573	2,494	2,575	2,044	2,034	2,054	2,033
21	230	657	651	1,249	11,154	6,230	2,492	2,575	2,024	(a)	2,063	2,047
22	343	818	646	1,055	4,068	6,694	3,322	2,575	2,032	2,033	2,056	2,004
23	347	647	654	2,036	6,815	5,313	2,502	2,299	(a)	2,037	2,055	2,024
24	350	825	653	2,044	11,400	3,495	2,421	2,030	2,029	2,032	2,056	(a)
25	352	483	557	2,372	9,376	6,062	2,493	2,043	2,031	2,038	(a)	(a)
26	360	795	652	2,494	6,655	6,380	2,513	(a)	2,052	2,039	(a)	(a)
27	356	790	636	2,490	5,505	6,314	2,690	2,035	2,040	2,045	(a)	2,045
28	257	786	637	2,502	5,885	4,250	4,188	2,037	2,045	(a)	2,043	2,051
29	726	.....	635	(a)	5,379	5,428	3,692	2,030	2,025	2,065	2,039	2,063
30	1,075	.....	643	2,495	6,319	2,887	5,556	2,031	(a)	2,032	2,031	2,055
31	1,195	.....	635	.....	5,098	.....	5,578	2,028	.....	2,032	.....	2,057

a Owing to incompleteness of records discharge rate can not be computed.

Monthly discharge of Penobscot River at Millinocket, Me., for 1906.

[Drainage area, 1,880 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	1,200	195	403	0.214	0.25
February	998	480	746	.397	.41
March	821	549	688	.366	.42
April	2,500	520	1,200	.638	.71
May	18,600	2,480	6,900	3.67	4.23
June	6,600	2,750	4,820	2.56	2.86
July	7,710	2,420	3,630	1.93	2.22
August	6,330	2,030	3,220	1.71	1.97
September	2,050	1,980	2,030	1.08	1.20
October	2,060	1,980	2,040	1.09	1.26
November	2,080	2,010	2,080	1.10	1.23
December	2,060	1,990	2,030	1.08	1.24
The year	18,600	195	2,480	1.32	18.00

NOTE.—Discharges for missing days have been interpolated.

PENOBSCOT RIVER AT WEST ENFIELD, ME.

This station was established November 5, 1901, and prior to 1904 was designated as being at Montague, Me. In 1904 the name of this village was changed to West Enfield. The gaging station is located at the steel highway bridge, about 1,000 feet below the mouth of

Piscataquis River. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 35, where are given also references to publications that contain data for previous years.

Discharge measurements of Penobscot River at West Enfield, Me., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
September 22 [a]	University of Maine students, under direction of Prof. H. S. Boardman	690	2,640	2.60	4,130
September 26 [a]	do	670	2,500	2.40	3,640
September 29 [a]	do	665	2,510	2.30	3,590
October 4 [a]	do	650	2,320	2.10	3,210
October 6 [a]	do	625	2,230	2.05	2,940
October 11 [a c]	do	865	6,800	6.80	18,600
October 13 [b]	do	850	5,300	5.60	12,600
October 24	do	843	4,040	4.15	8,320
October 31 [b]	do	860	5,340	5.65	12,800

[a] Average of three measurements.
[b] Average of two measurements.
[c] Gage height at beginning 6.5 feet, at end 7.1 feet; poor measurement.

Daily gage height, in feet, of Penobscot River at West Enfield, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					11.45	7.65	4.25	4.5	3.45	2.1	5.45	4.2
2	2.3				11.95	7.5	3.75	4.4	3.0	2.2	5.4	4.35
3				[a] 5.8	12.35	7.45	4.55	4.25	2.95	2.2	5.85	4.7
4				5.9	12.5	7.55	4.25	4.0	3.15	2.1	6.15	5.1
5				6.05	12.4	7.3	4.5	3.9	3.4	2.0	5.95	6.0
6		4.9	3.9	6.25	12.35	7.2	4.7	3.75	3.25	2.1	5.65	6.0
7				6.6	12.25	7.7	4.25	3.65	3.1	2.1	5.4	6.0
8				6.7	12.3	6.9	4.4	3.85	3.0	2.3	5.1	5.9
9	2.2			6.65	12.1	6.8	5.15	3.95	2.75	2.3	5.0	5.9
10				6.7	12.25	6.7	4.85	4.05	2.6	2.8	4.75	5.9
11				6.75	13.4	6.65	4.25	3.9	2.6	6.3	4.7	5.7
12				6.3	12.2	6.65	3.75	3.95	2.65	6.6	4.7	.....
13		4.6		6.1	11.45	6.4	4.65	3.7	2.5	5.55	4.8	.....
14			4.4	6.3	11.35	5.4	5.5	3.6	2.6	5.0	4.7	.....
15				6.85	11.65	4.5	5.2	3.35	2.55	4.5	4.9	.....
16	2.8			9.4	11.2	4.05	4.5	3.35	2.4	4.35	5.0	.....
17				11.45	11.6	4.25	4.15	3.35	2.4	4.15	5.25	5.0
18				12.15	11.3	4.7	4.15	3.4	2.3	3.9	5.25	.....
19			4.1	12.05	11.4	4.7	4.05	3.05	2.3	3.75	5.25	.....
20				11.95	10.75	4.75	4.0	3.3	2.35	3.55	5.5	.....
21				11.6	10.0	4.9	4.0	3.4	2.6	3.45	5.4	.....
22		3.8		11.65	8.85	5.55	4.05	3.5	2.55	3.5	5.5	.....
23	3.8			11.65	7.8	5.85	4.5	3.55	2.3	3.75	5.35	.....
24	5.2			11.25	8.35	5.4	4.4	3.8	2.4	4.15	5.25	6.0
25	6.6			10.8	8.75	5.05	4.3	3.5	2.4	4.4	4.75	.....
26	7.3		4.0	10.8	8.2	5.45	4.05	3.3	2.35	5.4	4.5	.....
27		4.1	4.2	10.85	7.75	5.05	3.85	3.45	2.35	6.0	4.4	.....
28				10.9	7.65	4.7	3.75	3.65	2.3	6.05	4.0	.....
29				11.1	7.8	4.35	4.0	3.8	2.3	6.2	4.0	.....
30	6.0			11.25	8.0	4.7	3.5	3.9	2.2	6.15	4.25	.....
31					8.15		4.2	4.1		5.6		5.5

NOTE.—The following ice conditions prevailed during 1906:

River frozen from January 1 to April 15, except that narrow channel remained open near the right bank; river again frozen December 4-31, inclusive.

During frozen period gage heights were taken to water surface through a hole in the ice. The following comparative readings were taken:

Comparative ice and water readings.

Date.	Water surface.	Top of ice.	Thickness of ice.	Date.	Water surface.	Top of ice.	Thickness of ice.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*	*Feet.*
January 2	2.3	.....	0.9	March 6	3.9	4.0	(a)
January 9	2.2	.....	1.0	March 14	4.4	4.0	(a)
January 16	2.8	.....	0.9	March 19	4.1	4.2	1.8
January 23	3.8	4.0	0.8	March 26	4.0	3.9	1.7
January 25	6.6	6.8	0.6	April 3 [b]	.....	5.8	.....
January 30	6.0	6.2	0.6	December 10	5.9	5.7	[c] 0.6
February 8	4.65	4.7	1.2	December 17	5.0	5.1	[c] 0.8
February 13	4.6	4.7	1.3	December 24	6.0	6.1	[c] 0.8
February 22	3.8	3.9	1.0	December 31	5.5	5.6	[c] 0.6
February 27	4.1	4.2	(a)				

[a] Open water in places and water on ice; unsafe to go upon.
[b] River open on east side under gage.
[c] River not entirely frozen over.

Rating table for Penobscot River at West Enfield, Me., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	3,000	3.30	5,740	4.60	9,430	6.80	17,390
2.10	3,170	3.40	5,990	4.70	9,750	7.00	18,260
2.20	3,350	3.50	6,240	4.80	10,070	7.20	19,170
2.30	3,530	3.60	6,500	4.90	10,390	7.40	20,120
2.40	3,720	3.70	6,770	5.00	10,720	7.60	21,110
2.50	3,920	3.80	7,050	5.20	11,380	7.80	22,140
2.60	4,130	3.90	7,330	5.40	12,060	8.00	23,200
2.70	4,340	4.00	7,620	5.60	12,750	9.00	29,000
2.80	4,560	4.10	7,910	5.80	13,460	10.00	35,450
2.90	4,790	4.20	8,210	6.00	14,200	11.00	42,350
3.00	5,020	4.30	8,510	6.20	14,960	12.00	49,750
3.10	5,260	4.40	8,810	6.40	15,740	13.00	57,600
3.20	5,500	4.50	9,120	6.80	16,550	13.40	60,800

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1901–6 and is well defined.

Monthly discharge of Penobscot River at West Enfield, Me., for 1906.

[Drainage area, 6,630 square miles.[a]]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April (16–31)	50,900	31,500	44,300	6.68	3.73
May	60,800	21,400	40,600	6.12	7.06
June	21,600	7,760	14,100	2.13	2.38
July	12,400	6,240	8,560	1.29	1.49
August	9,120	5,140	6,850	1.03	1.19
September	6,120	3,350	4,240	.640	.71
October	16,600	3,000	8,230	1.24	1.43
November	14,800	7,620	11,000	1.66	1.85

[a] Includes Chamberlain Lake drainage. (See description of St. John River drainage basin, Water-Supply Paper. No. 165, p. 20.)

NOTE.—The above values are rated as excellent.

EAST BRANCH PENOBSCOT RIVER AT GRINDSTONE, ME.

This station was established October 23, 1902. It is located at the Bangor and Aroostook Railroad bridge, one-half mile south of the railroad station. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 38, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of East Branch Penobscot River at Grindstone, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					9.4	7.1	4.85	4.6	6.0	4.9	4.75	5.3
2		5.4			9.6	7.2	5.45	4.5	5.9	4.9	4.9	5.3
3			5.6		9.7	7.9	6.2	4.6	5.7	4.8	5.05	5.2
4					9.8	7.1	6.85	4.5	5.6	4.8	5.2	5.15
5		5.1			9.85	8.4	6.65	4.5	5.45	4.7	5.35	5.1
6	4.5		5.15	6.3	9.9	8.25	6.7	4.4	5.3	4.6	5.45	5.0
7					10.25	8.65	7.85	4.35	5.15	4.6	5.7	4.95
8					10.4	8.7	7.8	4.35	5.1	4.7	5.8	4.9
9					9.9	8.65	7.85	4.2	5.0	4.7	5.9	4.85
10		5.1			9.6	8.65	7.5	4.25	4.9	5.05	6.3	4.85
11					9.3	8.7	7.45	4.3	4.9	5.85	6.25	4.8
12				5.7	9.3	8.65	7.4	4.4	4.8	6.4	6.1	4.8
13			5.2		9.3	7.35	7.7	4.4	4.8	6.8	6.0	4.7
14					9.3	7.75	7.85	4.4	4.7	6.7	6.0	4.7
15					9.0	7.25	7.65	4.35	4.7	6.5	5.95	4.7
16	4.5			8.3	9.0	6.85	7.65	4.3	4.7	6.4	5.9	4.6
17					9.0	6.55	7.6	4.25	4.7	6.15	5.9	4.5
18			5.2	8.7	8.8	7.8	7.5	4.2	4.8	6.1	5.85	4.5
19					8.7	6.55	7.3	4.2	4.85	5.8	5.9	4.45
20		5.0			8.6	6.45	7.35	4.1	4.9	5.55	5.95	4.4
21					8.7	8.55	6.4	7.35	4.1	5.0	5.45	6.15	4.4
22	5.0				8.7	9.3	6.5	7.1	4.2	5.1	5.4	6.25	4.4
23					8.7	9.0	5.6	7.3	4.2	5.1	5.2	6.2	4.4
24					7.8	8.7	5.85	6.9	4.2	5.1	5.15	6.1	4.4
25			6.3		8.05	8.9	5.75	6.55	4.2	5.05	5.1	5.9	4.4
26					8.4	8.75	5.45	6.4	4.5	5.0	5.0	5.85	4.4
27					8.7	8.8	5.25	6.2	4.65	5.0	5.05	5.75	4.3
28					8.9	8.4	5.4	6.15	4.9	4.95	5.15	5.7	4.3
29					9.1	8.35	4.85	5.75	5.3	4.9	5.05	5.6	4.3
30					9.35	7.3	4.85	5.25	5.45	4.8	4.9	5.5	4.3
31						7.2		4.85	5.75		4.8		4.3

NOTE.- The following ice conditions prevailed during 1906: River frozen January 1 to April 21, and November 25 to December 31, inclusive. During the frozen period gage heights were taken to water surface through a hole in the ice. The following comparative readings were taken:

Comparative ice and water readings.

Date.	Water surface.	Top of ice.	Thickness of ice.	Date.	Water surface.	Top of ice.	Thickness of ice.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*	*Feet.*
January 6	4.5	4.5	0.8	March 25	6.3	6.3	2.0
January 16	4.5	4.5	.9	April 6	6.3	6.3	1.8
January 22	5.0	5.0	.9	April 12	5.7	5.7	1.4
February 2	5.4	5.4	.9	April 16	8.3	8.3	1.2
February 5	5.1	5.1	1.2	November 25	5.85		.1
February 10	5.1	5.1	1.4	December 2	5.3		.2
February 20	5.0	5.0	1.8	December 9	4.85		.3
March 3	5.6	5.6	2.1	December 16	4.6		.8
March 6	5.15	5.15	1.9	December 23	4.4	4.4	1.0
March 13	5.2	5.2	2.0	December 30	4.3		1.2
March 18	5.2	5.2	2.0				

Gage heights were probably affected by log jams on Grindstone Falls during June and up to July 26, when the river was reported clear. From August 27 to October 16, inclusive, a jam of poles and ties at the bridge was reported.

Rating table for East Branch of Penobscot River at Grindstone, Me., for 1905-6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.10	210	5.30	855	6.50	2,285	8.40	6,110
4.20	240	5.40	940	6.60	2,445	8.60	6,630
4.30	275	5.50	1,030	6.70	2,610	8.80	7,190
4.40	315	5.60	1,130	6.80	2,780	9.00	7,780
4.50	360	5.70	1,235	6.90	2,955	9.20	8,380
4.60	405	5.80	1,345	7.00	3,130	9.40	8,980
4.70	455	5.90	1,460	7.20	3,495	9.60	9,580
4.80	510	6.00	1,580	7.40	3,880	9.80	10,180
4.90	570	6.10	1,705	7.60	4,285	10.00	10,780
5.00	630	6.20	1,840	7.80	4,710	10.20	11,380
5.10	700	6.30	1,980	8.00	5,155	10.40	12,000
5.20	775	6.40	2,130	8.20	5,620		

NOTE.—The above table is applicable only for open-channel conditions. It is based on thirteen discharge measurements made during 1902-5 and is well defined.

Monthly discharge of East Branch Penobscot River at Grindstone, Me., for 1906.

[Drainage area, 1,130 square miles.[a]]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April 21-30	8,830	4,710	6,810	6.03	2.24
May	12,000	3,500	8,150	7.21	8.31
June	6,900	540	3,540	3.13	3.49
July	4,820	540	3,100	2.74	3.16
August	1,290	210	377	.334	.39
September	1,580	455	708	.627	.70
October	2,780	405	1,040	.920	1.06
November 1-24	1,980	482	1,380	1.22	1.09

[a] Includes Chamberlain Lake drainage. See description of St. John River drainage basin, pp. 22-23.

NOTE.—Values are rated as follows: April and May, excellent; June to October, fair; November, good.

MATTAWAMKEAG RIVER AT MATTAWAMKEAG, ME.

This station was established August 26, 1902. It is located at the Maine Central Railroad bridge in the village of Mattawamkeag. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 41, where are given also references to publications that contain data for previous years.

A measurement was made August 23, 1906, by F. E. Pressey, with the following results:

Width, 257 feet; area, 220 square feet; gage height, 3.08 feet; discharge, 250 second-feet.

Daily gage height, in feet, of Mattawamkeag River at Mattawamkeag, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		8.7		9.7	10.4	7.2	4.45	3.6	3.35	2.7	6.2	5.4
2		8.4			10.6	7.05	4.2	3.8	3.25	2.6	6.1	5.45
3		8.0			10.7	6.7	4.0	3.8	3.2	2.6	6.0	5.5
4		7.7	9.2		10.8	6.8	4.2	3.75	3.3	2.6	6.0	
5					11.05	7.35	4.5	3.7	3.6	2.6	6.1	
6					11.1	7.1	4.35	3.7	3.6	2.5	6.2	
7	3.7				11.1	6.9	4.4	3.7	3.7	2.7	6.05	
8		9.5		9.9	11.1	6.7	4.25	3.65	3.6	3.0	5.9	
9					10.9	6.6	3.95	3.6	3.5	3.3	5.8	5.7
10					10.7	6.2	4.2	3.45	3.5	3.65	5.85	

Daily gage height, in feet, of Mattawamkeag River at Mattawamkeag, Me., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11					10.7	5.8	4.1	3.4	3.4	4.4	6.0	
12			8.5		10.4	5.4	4.2	3.4	3.4	5.75	6.0	
13		9.5			10.1	4.9	4.3	3.4	3.2	6.0	5.9	
14	3.7			8.6	9.9	4.6	4.4	3.35	3.1	6.0	5.8	
15				8.6	9.95	4.45	4.5	3.3	3.0	5.9	5.8	
16				9.8	9.55	4.3	4.4	3.3	3.0	5.8	5.8	6.6
17				9.6	9.25	4.1	4.3	3.3	2.8	5.65	5.9	
18			8.6	9.75	8.9	3.9	4.3	3.3	2.6	5.45	5.9	
19				10.1	8.8	3.8	4.2	3.3	2.5	5.2	6.0	
20		8.8		10.55	8.25	4.05	4.2	3.2	2.6	4.85	6.2	
21				10.65	7.5	4.65	4.5	3.1	2.6	4.8	6.3	
22	3.8			10.7	7.2	5.05	4.2	3.05	2.6	4.7	6.3	
23				10.7	7.05	5.5	4.2	3.15	2.65	4.8	6.2	6.9
24				10.75	7.4	5.6	4.2	3.2	2.7	5.0	6.1	
25	11.6	9.3	8.4	10.8	7.2	5.6	4.2	3.2	2.7	5.1	6.0	
26	11.6			10.6	6.55	5.6	4.2	3.2	2.7	5.55	5.8	
27	11.4			10.6	6.5	5.2	4.2	3.2	2.7	5.95	5.7	
28	11.05			10.4	6.4	4.9	4.1	3.3	2.7	6.15	5.7	
29	11.0			10.4	6.45	4.8	4.1	3.4	2.7	6.3	5.5	
30	10.75			10.3	6.8	4.55	3.85	3.45	2.7	6.2	5.3	6.7
31	9.0				6.8		3.7	3.5		6.2		

NOTE.—The following ice condition prevailed during 1906: River frozen over January 1 to 24; open January 25 to February 3; frozen February 4 to April 13; clear of ice April 17. River frozen December 4 to 31. During the frozen period gage heights were taken to water surface through a hole in the ice. The following comparative readings were taken:

Comparative ice and water readings.

Date.	Water surface.	Top of ice.	Thickness of ice.	Date.	Water surface.	Top of ice.	Thickness of ice.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*	*Feet.*
January 7	3.7	3.7	1.1	March 12	8.5	8.7	1.2
January 14	3.7	3.7	1.3	March 18	8.6	8.7	1.5
January 22	3.8	3.8	1.5	March 25	8.4	8.5	1.4
February 4	7.7	7.7	.6	April 1	9.8	9.7	1.2
February 8	9.5	9.7	.8	April 8		9.9	
February 13	9.5	9.3	.8	December 9	5.7	5.8	.5
February 20	8.8	8.6	1.1	December 16	6.6	6.7	.7
February 25	9.3	9.5	.9	December 23	6.9	7.0	.9
March 4	9.2	9.4	1.0	December 30	6.7	6.8	1.0

Rating table for Mattawamkeag River at Mattawamkeag, Me., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.50	86	3.90	590	5.20	1,949	7.00	5,075
2.60	100	4.00	660	5.30	2,083	7.20	5,495
2.70	114	4.10	736	5.40	2,219	7.40	5,920
2.80	134	4.20	818	5.50	2,359	7.60	6,360
2.90	160	4.30	906	5.60	2,505	7.80	6,810
3.00	190	4.40	1,000	5.70	2,658	8.00	7,275
3.10	223	4.50	1,100	5.80	2,818	8.20	7,750
3.20	258	4.60	1,206	5.90	2,985	8.40	8,235
3.30	295	4.70	1,318	6.00	3,160	8.60	8,730
3.40	334	4.80	1,436	6.20	3,525	8.80	9,235
3.50	375	4.90	1,559	6.40	3,900	9.00	9,750
3.60	420	5.00	1,687	6.60	4,285	10.00	12,520
3.70	470	5.10	1,817	6.80	4,675	11.00	15,590
3.80	525						

NOTE.—The above table is applicable only for open-channel conditions. It is based on twenty-three discharge measurements made during 1902–6 and is well defined between gage heights 2.6 feet and 9.5 feet.

Monthly discharge of Mattawamkeag River at Mattawamkeag, Me., for 1906.

[Drainage area, 1,510 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April (17-30)	14,900	11,400	13,800	9.14	4.76
May	15,900	3,900	10,300	6.82	7.86
June	5,810	525	2,650	1.75	1.95
July	1,100	470	834	.552	.64
August	525	206	345	.228	.26
September	470	86	223	.148	.17
October	3,710	86	1,720	1.14	1.31
November	3,710	2,080	3,080	2.04	2.28

NOTE.—Values for 1906 are rated as excellent.

PISCATAQUIS RIVER NEAR FOXCROFT, ME.

This station was established August 17, 1902. It is located at Low's bridge, about halfway between Guilford and Foxcroft. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 44, where are given also references to publications that contain data for previous years.

Discharge measurements of Piscataquis River near Foxcroft, Me., in 1906.

Date	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 22	F. E. Pressey	100	210	2.73	320
August 31	do	102	205	2.81	330

Daily gage height, in feet, of Piscataquis River near Foxcroft, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.2	3.8	3.5	3.8	5.8	3.3	2.0	2.6	2.6	2.3	3.5	3.2
2	2.2	3.6	3.2	3.8	6.2	3.0	2.4	2.6	2.6	2.8	3.6	3.8
3	2.2	3.4	3.2	3.8	6.1	3.4	2.4	2.5	2.7	2.8	3.6	3.8
4	2.2	2.9	2.8	3.8	6.1	3.4	2.4	2.4	2.7	1.9	3.6	3.8
5	2.8	3.4	3.5	3.8	6.2	3.4	2.3	2.3	2.7	1.9	3.6	3.7
6	2.2	3.4	3.6	4.0	6.2	3.5	2.2	2.3	2.7	1.8	3.4	3.7
7	2.2	3.2	3.4	4.0	5.9	4.8	2.2	2.2	2.6	1.6	3.4	3.5
8	2.2	3.0	3.4	3.8	5.5	4.2	1.8	2.1	2.5	2.2	3.2	3.4
9	2.2	3.0	3.1	3.8	5.2	3.8	2.1	2.0	2.4	2.2	3.2	3.4
10	2.2	3.0	3.1	3.6	8.1	3.5	2.1	2.2	2.5	3.8	3.0	3.2
11	2.2	2.8	2.8	3.4	6.5	3.0	2.2	2.2	2.5	4.2	3.0	3.2
12	2.2	3.1	2.8	3.3	5.1	3.0	3.4	2.2	2.5	3.5	3.1	3.2
13	2.2	3.1	3.0	3.2	4.6	3.0	2.8	2.3	2.4	3.3	3.1	3.2
14	2.2	3.1	3.0	3.2	5.1	2.8	2.8	2.3	2.6	2.8	3.1	3.4
15	2.2	3.0	3.0	3.8	4.8	2.8	2.5	2.2	2.5	2.8	3.1	3.8
16	2.4	3.2	3.0	8.0	4.7	2.6	2.6	2.2	2.0	2.7	3.0	3.6
17	2.5	3.4	2.8	10.0	4.6	2.6	2.6	2.2	2.0	2.4	3.3	3.2
18	3.0	2.5	3.0	7.6	4.5	2.6	2.6	2.2	2.4	2.4	3.4	3.4
19	3.2	3.4	3.2	6.4	3.5	2.6	2.6	2.7	2.4	2.4	3.4	3.4
20	3.3	3.4	3.4	6.3	3.5	2.3	2.5	2.4	3.2	2.0	3.4	3.4
21	3.3	3.4	3.4	6.3	3.6	2.0	2.4	2.4	3.0	2.8	3.4	3.5
22	3.4	3.4	3.4	6.5	3.6	2.3	3.2	2.4	2.6	2.9	3.3	3.6
23	3.6	3.4	3.4	6.5	3.6	2.3	2.9	2.5	2.4	3.0	3.2	3.7
24	3.8	3.6	3.2	6.0	3.0	2.6	2.9	2.7	2.2	3.0	3.1	3.7
25	4.4	3.4	3.1	4.2	3.0	2.9	2.9	2.6	2.8	3.3	3.1	3.6

Daily gage height, in feet, of Piscataquis River near Foxcroft, Me., for 1906—Cont'd.

Day.	Jan	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26	4.6	3.1	3.2	4.6	3.2	2.6	2.6	2.5	2.7	4.2	3.3	3.6
27	4.6	3.0	3.4	4.8	3.2	2.6	2.6	3.0	2.8	3.8	3.3	3.4
28	4.2	3.4	3.5	5.6	3.8	2.2	2.6	3.2	2.4	3.7	3.3	3.4
29	4.2	.....	3.8	5.6	3.8	2.2	2.4	2.9	2.2	3.8	3.2	3.4
30	3.8	.....	3.8	5.4	3.8	2.1	2.6	2.8	1.7	3.4	3.2	3.4
31	3.8	.....	4.0	.....	3.5	.....	2.6	2.7	.....	3.4	.....	3.4

NOTE.—River frozen over through February and probably through January. Gage heights are to water surface in hole cut in ice. River open on April 7. The following thicknesses of ice were obtained: February 17, 1.4; February 24, 1.1; March 3, 1.2; March 10, 1.0; March 17, 1.5; March 24, 1.7; March 31, 1.5.

Rating table for Piscataquis River near Foxcroft, Me., for 1904–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.60	24	2.90	374	4.20	1,403	6.00	3,970
1.70	31	3.00	437	4.30	1,508	6.20	4,335
1.80	40	3.10	502	4.40	1,615	6.40	4,705
1.90	51	3.20	569	4.50	1,725	6.60	5,080
2.00	64	3.30	638	4.60	1,840	6.80	5,460
2.10	81	3.40	709	4.70	1,960	7.00	5,840
2.20	100	3.50	782	4.80	2,085	7.20	6,230
2.30	123	3.60	858	4.90	2,215	7.40	6,620
2.40	148	3.70	938	5.00	2,350	7.60	7,010
2.50	180	3.80	1,023	5.20	2,635	7.80	7,410
2.60	220	3.90	1,113	5.40	2,940	8.00	7,810
2.70	267	4.00	1,208	5.60	3,265	9.00	9,860
2.80	318	4.10	1,303	5.80	3,610	10.00	11,960

NOTE.—The above table is applicable only for open-channel conditions. It is based on 24 discharge measurements made during 1902–1906 and is well defined below gage heights 6.0 feet.

Monthly discharge of Piscataquis River near Foxcroft, Me., for 1906.

[Drainage area, 280 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April (16–30)	12,000	1,400	4,610	16.46	9.18
May	8,020	437	2,320	8.29	9.56
June	2,080	64	461	1.65	1.84
July	709	40	220	.786	.91
August	569	64	185	.661	.76
September	569	31	207	.739	.82
October	1,400	24	464	1.66	1.91
November	858	437	628	2.24	2.50
December	1,020	569	776	2.77	3.19

NOTE.—Values are rated as follows: April, good; May to December, excellent.

COLD STREAM AT ENFIELD, ME.

This station was established June 14, 1904, and was located at the highway bridge about three-fourths mile south of Enfield on the road to Passadumkeag. On September 12, 1904, to avoid backwater effects from Passadumkeag stream the gage was taken from the highway bridge and placed about 200 feet below the old mill near Enfield post-office. The conditions at the station and the bench marks are described in Water-Supply Paper No. 165, page 46, where are given also references to publications that contain data for previous years.

Discharge measurements of Cold Stream at Enfield, Me., in 1904-1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1904.					
September 9	H. K. Barrows		17	2.72	36
October 12	F. E. Pressey		20	2.75	37
October 21	do		23	2.92	56
November 4	do		25	2.90	54
1905.					
April 28	F. E. Pressy	33	19.7	2.68	22.6
May 3	do	41	44	3.33	168
May 8	do	33	19.3	2.63	29.3
May 26	do	32	23	2.78	52
May 26	do	28	18.2	2.78	35
May 26	do	16.5	22	2.78	42
June 24	do	32	23	2.80	52
October 23	do	30	14.1	2.68	21.3
November 28	do	31	12.4	2.64	15.9
1906.					
February 24	F. E. Pressy	31	11.3	2.66	17
April 13	do	35	26	3.04	77
April 30	do	36	27	3.10	83

Daily gage height, in feet, of Cold Stream at Enfield, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.6	2.7	2.6	2.8	3.1	3.2	3.0	2.8	2.7	2.8	2.6	2.6
2	2.4	2.7	2.7	2.8	3.1	3.2	3.0	2.8	2.7	2.8	2.6	2.6
3	2.6	2.6	2.7	2.8	3.1	3.1	3.0	2.8	2.7	2.9	2.6	2.6
4	2.6	2.6	2.7	2.8	3.1	3.1	3.1	2.8	2.8	2.8	2.6	2.6
5	2.6	2.6	2.6	2.7	3.2	3.2	3.1	2.9	2.8	2.8	2.6	[a] 4.0
6	2.5	2.6	2.6	2.9	3.2	3.2	3.1	2.9	2.7	2.7	2.7	[a] 2.9
7	2.6	2.6	2.7	2.9	3.2	3.2	3.0	2.9	2.7	2.7	2.7	2.7
8	2.6	2.5	2.7	3.0	3.2	3.2	3.0	2.8	2.7	2.7	2.7	2.7
9	2.6	2.7	2.7	2.9	3.1	3.2	3.0	2.8	2.7	2.7	2.7	2.6
10	2.6	2.7	2.7	3.0	3.1	3.4	3.0	2.8	2.7	2.8	2.7	2.6
11	2.6	2.7	2.6	2.9	3.0	3.9	3.0	2.8	2.7	2.7	2.6	2.7
12	2.7	2.7	2.6	2.9	3.0	3.8	3.0	2.8	2.7	2.7	2.6	2.7
13	2.7	2.6	2.6	3.3	3.1	3.8	3.0	2.8	2.7	2.7	2.7	2.6
14	2.7	2.7	2.6	3.0	3.1	3.8	3.0	2.8	2.7	2.7	2.7	2.7
15	2.7	2.7	2.5	3.0	3.1	3.7	3.0	2.8	2.7	2.7	2.7	2.7
16	2.6	2.7	2.5	3.0	3.2	3.6	3.1	2.7	2.7	2.6	2.7	2.7
17	2.7	2.7	2.5	3.3	3.3	3.7	3.1	2.7	2.8	2.8	2.7	2.7
18	2.7	2.7	2.7	3.1	3.3	3.7	3.0	2.7	2.7	2.8	2.7	2.7
19	2.6	2.7	2.7	2.9	3.4	3.6	3.0	2.7	2.7	2.8	2.7	2.6
20	2.6	2.7	2.7	2.9	3.4	3.6	3.0	2.8	2.8	2.7	2.7	2.6
21	2.7	2.6	2.7	2.9	3.4	3.4	3.0	2.8	2.7	2.7	2.8	2.6
22	2.7	2.7	2.5	2.9	3.3	3.1	3.0	2.8	2.8	2.6	2.8	2.8
23	2.7	2.7	2.6	3.3	3.3	3.0	3.0	2.8	2.8	2.6	2.8	2.8
24	2.6	2.7	2.7	3.3	3.2	3.0	2.9	2.8	2.8	2.7	2.8	2.8
25	2.6	2.7	2.7	3.3	3.2	3.1	2.9	2.8	2.8	2.7	2.7	2.7
26	2.7	2.7	2.7	3.1	3.2	3.1	2.9	2.8	2.8	2.6	2.7	2.7
27	2.7	2.6	2.6	3.1	3.2	3.1	2.9	2.8	2.8	2.7	2.7	2.6
28	2.6	2.6	2.6	3.1	3.2	3.2	2.8	2.7	2.8	2.8	2.7	2.6
29	2.6	2.6	2.8	3.1	3.2	3.2	2.8	2.7	2.8	2.7	2.7	2.7
30	2.6	.....	2.7	3.1	3.2	3.1	2.8	2.8	2.8	2.7	2.6	2.7
31	2.6	.....	2.7	.....	3.1	.....	2.8	2.8	.....	.....	.....	2.8

[a] Backwater from anchor ice on riffles below station.

NOTE.—Ice does not usually form at this station. It sometimes forms to a thickness of 0.2 foot during the night but invariably goes out during the day. The following thicknesses of ice were obtained: February 3, 2 inches; February 15, 2 inches; March 12, 2 inches; March 13, 1 inch; March 23, 2 inches.

Rating table for Cold Stream at Enfield, Me., for 1904–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	2	2.90	52	3.40	158	3.90	316
2.50	6	3.00	69	3.50	186	4.00	353
2.60	12	3.10	88	3.60	216		
2.70	24	3.20	109	3.70	248		
2.80	37	3.30	132	3.80	281		

NOTE.—The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1904–1906 and is fairly well defined between gage heights 2.6 feet and 3.2 feet. Below gage height 2.6 feet it is very uncertain.

Monthly discharge of Cold Stream at Enfield, Me., for 1904–1906.

[Drainage area, 26 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1904.					
September (10–30)	69	2	39.9	1.53	1.19
October	69	6	53.2	2.05	2.36
November	69	12	33.5	1.29	1.44
December	37	12	22.6	.869	1.00
1905.					
January	52	12	22.8	.877	1.01
February	37	12	24.1	.927	.97
March	37	12	26.3	1.01	1.16
April	248	12	42.2	1.62	1.81
May	316	12	66.5	2.56	2.95
June	52	24	35.9	1.38	1.54
July	52	12	36.1	1.39	1.60
August	24	2	6.65	.256	.30
September	37	6	27.3	1.05	1.17
October	24	12	19.0	.731	.84
November	24	12	17.6	.677	.76
December [a]	24	10	13.7	.527	.61
The year	316	2	28.2	1.08	14.72
1906.					
January	24	2	15.7	.604	.70
February	24	6	19.5	.750	.78
March	37	6	11.8	.454	.52
April	132	24	72.4	2.78	3.10
May	158	69	107	4.12	4.75
June	316	69	153	5.88	6.56
July	88	37	65.7	2.53	2.92
August	52	24	35.9	1.38	1.59
September	37	24	29.6	1.14	1.27
October	52	12	26.9	1.03	1.19
November	37	12	22.5	.865	.97
December [b]	37	12	20.6	.792	.91
The year	316	2	48.4	1.86	25.26

[a] River frozen December 11 to 13, 1905; discharge estimated 10 second-feet.
[b] Backwater December 5 and 6; discharge corrected.

NOTE.—Values 1904 to 1906, approximate, owing to local changes in control which could not be covered by meter measurements.

PHILLIPS LAKE AND OUTLETS IN HOLDEN AND DEDHAM, ME.

The United States Geological Survey maintains gages at the two outlets of Phillips Lake; also a gage for obtaining a record of lake level. The station at the northern outlet was established July 7, 1904. It is located about 1¼ miles from the lake, one-fourth mile south of the village of East Holden, and 175 feet south of an old mill.

The station at the southeastern outlet was established July 19, 1904. It is located at the highway bridge about 1½ miles southeast of Lake House railroad station, and is about 700 feet southeast of the Maine Central Railroad crossing. The station on Phillips Lake was established July 19, 1904. It is located about one-fourth mile west of Lake House railroad station. The conditions at these stations and the bench marks are described in Water-Supply Paper No. 165, page 48, where are given also references to publications that contain data for previous years.

Discharge measurements of Phillips Lake, northern outlet at East Holden, Me., in 1904–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1904.					
July 19	H. K. Barrows		7.86	1.55	9.66
August 18	F. E. Pressey		6.54	1.45	6.29
October 17	do		4.36	1.46	5.64
1905.					
April 17	F. E. Pressey	15.5	9.9	1.84	24.2
April 29 [a]	do	17.0	11.1	1.90	27.2
May 25 [a]	do	17.0	12.2	1.90	30.7
June 17	Pressey and Adams	12.5	11.5	1.82	21.5
August 11	F. E. Pressey	12.5	9.2	1.77	15.0
August 15	Barrows and Pressey	9.3	8.6	1.67	11.0
September 2	F. E. Pressey	9.5	9.3	1.74	12.6
October 21	do	5.7	3.0	1.41	1.8
1906.					
February 23	F. E. Pressey	18	16.6	2.38	59
March 5	do	14	12.3	2.34	46
April 14	do	14	13.1	2.34	44
April 27	do	14	12.9	2.28	40
May 23	do	16	17.8	2.52	52
August 24	Barrows and Pressey	11	14.4	1.85	17.2

[a] From log across stream 100 feet below gage.

Discharge measurements of Phillips Lake, southeastern outlet near Lake House railroad station, Me., in 1904–06.

Date.	Hydrographer.	Width.	Area of section.	Gage height.		Discharge.
				Outlet.	Phillips Lake.	
		Feet.	*Sq. ft.*	*Feet.*	*Feet.*	*Sec.-ft.*
1904.						
July 19	H. K. Barrows		1.23	1.42	7.05	1.09
August 18	F. E. Pressey		.20	1.14	6.40	.07
October 17	do		1.25	1.49	7.34	1.48
1905.						
April 17	F. E. Pressey	8.0	19.3	2.80	9.40	42.7
April 29	do	8.0	15.4	2.28	8.94	12.2
May 25	do	8.0	14.3	2.20	8.97	11.9
June 17	Pressey and Adams	4.0	1.8	1.62	8.48	3.3
August 11	F. E. Pressey	2.5	1.19	1.38	7.37	1.25
August 15	Barrows and Pressey	2.5	1.06	1.35	7.20	1.04
September 2	F. E. Pressey	.5	.08	1.06	6.40	.05
October 31	do	.35	.05	1.10	6.00	.03
1906.						
February 23	F. E. Pressey	3	1.26	1.50	7.55	1.69
March 5	do	3	1.17	1.94	7.25	1.21
April 27	do	8	18.2	2.90	9.35	44.2
May 23	do	12	10.2	2.20	8.80	13.5
August 24	Barrows and Pressey	3	.60	1.15	6.05	.01

Daily gage height, in feet, of Phillips Lake, northern outlet, at East Holden, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.8	2.3	2.4	2.4	2.5	2.5	1.8	1.65	1.8	1.55	1.9	1.7
2	2.0	2.3	2.45	2.45	2.2	2.35	2.45	1.65	1.8	1.55	2.1	1.7
3	2.3	2.5	2.4	2.4	2.5	2.0	1.8	1.65	1.8	1.55	2.3	1.8
4	1.85	2.2	2.5	2.15	2.2	2.45	2.3	1.65	1.8	1.55	2.3	1.8
5	1.85	2.2	2.35	1.8	2.2	2.4	2.3	1.65	1.8	1.55	2.3	1.8
6	1.85	2.2	2.3	2.45	2.2	2.5	2.35	1.65	1.75	1.55	2.3	1.8
7	2.0	2.1	2.05	2.5	2.5	2.55	2.2	1.65	1.7	1.55	2.3	1.8
8	2.2	2.05	2.05	1.8	2.3	2.3	1.8	1.65	1.7	1.55	2.4	1.7
9	1.85	2.05	2.3	2.3	2.25	2.0	1.7	1.65	1.65	1.55	2.4	1.7
10	2.6	2.05	2.4	2.35	2.5	2.0	1.7	1.65	1.6	1.55	2.4	1.7
11	2.0	2.0	2.5	2.3	2.4	2.4	1.8	1.7	1.6	1.55	1.9	1.7
12	1.9	2.0	2.45	2.3	2.2	2.3	1.7	1.65	1.6	1.55	2.4	1.7
13	1.8	2.05	2.4	2.4	2.2	2.4	1.7	1.65	1.6	1.55	2.4	1.7
14	1.8	2.5	2.5	2.3	2.25	2.25	1.7	1.65	1.6	1.55	2.4	1.7
15	1.8	2.5	2.45	2.15	2.45	2.4	1.7	1.65	1.6	1.6	2.4	1.7
16	2.2	2.2	2.3	2.55	2.3	2.4	1.7	1.65	1.6	1.55	2.25	1.7
17	2.3	2.5	2.3	2.32	2.05	2.0	1.7	1.65	1.6	1.55	2.4	1.7
18	2.1	2.3	2.3	2.38	2.05	2.3	1.7	1.7	1.6	1.55	1.9	1.7
19	2.1	2.35	2.3	2.38	2.05	2.4	1.7	1.9	1.6	1.55	2.5	1.7
20	2.1	2.5	2.25	2.42	2.0	2.35	1.7	1.9	1.6	1.55	2.5	1.7
21	2.1	2.2	2.1	2.42	2.0	2.4	1.7	1.9	1.6	1.55	2.4	1.75
22	2.1	2.5	2.5	2.2	2.05	2.4	1.7	1.9	1.55	1.55	2.4	1.75
23	2.1	2.35	2.3	2.4	2.25	2.45	1.7	1.9	1.55	1.5	2.4	1.75
24	2.55	2.4	2.2	2.15	2.4	1.9	1.7	1.9	1.55	1.45	2.4	1.8
25	2.4	2.2	2.2	2.4	2.5	2.3	1.65	1.9	1.55	1.5	1.9	1.8
26	2.4	2.3	2.3	2.5	2.4	2.4	1.65	1.9	1.55	1.95	1.7	1.8
27	2.5	2.5	2.3	2.3	2.0	2.3	1.65	1.85	1.55	1.95	1.7	1.8
28	2.4	2.5	2.5	2.2	2.05	2.4	1.65	1.85	1.55	1.6	1.7	1.8
29	2.4	.....	2.5	2.2	2.3	2.55	1.65	1.8	1.55	1.75	1.7	1.8
30	2.4	.....	2.5	2.4	2.3	2.15	1.65	1.8	1.55	1.6	1.7	1.8
31	2.4	.....	2.55	.....	2.4	.....	1.65	1.8	.....	1.9	.....	1.8

NOTE.—The outlet does not freeze over near the gage, but during short periods the gage height may be affected by ice conditions downstream.

Daily gage height, in feet, of Phillips Lake near East Holden, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	.....	.....	.....	.....	.....	5.8	.....	.....	5.9
2	.....	.....	.....	.....	.....	9.3	.....	.....	.....	.....	.....	.....
3	.....	8.7	7.1	.....	.....	.....	.....	.....	.....	.....	5.35	.....
4	.....	.....	.....	.....	.....	.....	.....	6.7	.....	.....	.....	.....
5	.....	.....	.....	.....	9.4	.....	.....	.....	.....	.....	.....	.....
6	7.8	.....	.....	.....	.....	.....	.....	.....	.....	5.35	.....	.....
7	.....	.....	.....	6.8	.....	.....	7.2	.....	.....	.....	.....	.....
8	.....	.....	.....	.....	.....	.....	.....	.....	5.7	.....	.....	6.1
9	.....	.....	.....	.....	.....	9.1	.....	.....	.....	.....	.....	.....
10	.....	8.4	7.4	.....	.....	.....	.....	.....	.....	.....	5.3	.....
11	.....	.....	.....	.....	.....	.....	.....	6.6	.....	.....	.....	.....
12	.....	.....	.....	.....	9.4	.....	.....	.....	.....	.....	.....	.....
13	7.9	.....	.....	.....	.....	.....	.....	.....	.....	5.35	.....	.....
14	.....	.....	.....	7.3	.....	.....	7.1	.....	.....	.....	.....	.....
15	.....	.....	.....	.....	.....	.....	.....	.....	5.5	.....	.....	6.1
16	.....	.....	.....	.....	.....	8.6	.....	.....	.....	.....	.....	.....
17	.....	8.1	6.8	.....	.....	.....	.....	.....	.....	.....	5.35	.....
18	.....	.....	.....	.....	.....	.....	.....	6.4	.....	.....	.....	.....
19	.....	.....	.....	.....	9.1	.....	.....	.....	.....	.....	.....	.....
20	8.3	.....	.....	.....	.....	.....	.....	.....	.....	5.3	.....	.....
21	.....	.....	.....	9.2	.....	.....	6.9	.....	.....	.....	.....	.....
22	.....	.....	.....	.....	.....	.....	.....	.....	5.4	.....	.....	6.4
23	.....	7.6	.....	.....	8.8	8.1	.....	.....	.....	.....	.....	.....
24	.....	7.5	6.4	.....	.....	.....	.....	.....	.....	.....	5.7	.....
25	.....	.....	.....	.....	.....	.....	.....	6.2	.....	.....	.....	.....
26	.....	.....	.....	.....	8.7	.....	.....	.....	.....	.....	.....	.....
27	8.8	.....	.....	.....	.....	.....	.....	.....	.....	4.1	.....	.....
28	.....	.....	.....	9.4	.....	.....	6.9	.....	.....	.....	.....	.....
29	.....	.....	.....	.....	.....	.....	.....	.....	5.45	.....	.....	6.8
30	.....	.....	.....	.....	.....	7.6	.....	.....	.....	.....	.....	.....
31	.....	.....	6.4	.....	.....	.....	.....	.....	.....	.....	.....	.....

NOTE.—The lake did not freeze over at the gage during the year.

Rating table for Phillips Lake, northern outlet, at East Holden, Me., for 1904–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	1.3	1.80	15.8	2.20	36.5	2.50	53
1.50	3.6	1.90	20.5	2.30	42	2.60	59
1.60	7.2	2.00	25.5	2.40	47.5	2.70	65
1.70	11.3	2.10	31				

NOTE.—The above table is applicable only for open-channel conditions. It is based on ten discharge measurements made during 1904-1906, and is fairly well defined.

Rating table for Phillips Lake, southeastern outlet, near Lake House railroad station, Me., for 1904–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
6.00	0.02	7.00	0.80	8.00	2.4	8.90	13
6.10	.03	7.10	.95	8.10	2.6	9.00	17
6.20	.04	7.20	1.10	8.20	2.9	9.10	23
6.30	.05	7.30	1.25	8.30	3.2	9.20	29
6.40	.07	7.40	1.40	8.40	3.6	9.30	37
6.50	.10	7.50	1.55	8.50	4.2	9.40	46
6.60	.20	7.60	1.70	8.60	5.3	9.50	55
6.70	.35	7.70	1.85	8.70	7.0	9.60	65
6.80	.50	7.80	2.0	8.80	9.5	9.70	75
6.90	.65	7.90	2.2				

NOTE.—The above table is applicable only for open-channel conditions. It is based on sixteen discharge measurements made during 1904-1906, and is fairly well defined. It applies to gage heights of Philips Lake.

Monthly discharge of Phillips Lake outlets, in Holden and Dedham, Me., for 1904–1906.

[Drainage area, 12.3 square miles.]

Month.	Discharge in second-feet.					Run-off.	
	Northern outlet.			Southeastern outlet			
	Maximum.	Minimum.	Mean.	Mean.	Total.	Sec.-ft. per sq. mile.	Depth in inches.
1904.							
July (7-31)	11.3	3.6	6.11	[a] 0.61	.....	.....	.....
August	11.3	1.3	4.62	[b] .14	.....	.....	.....
September	3.6	1.3	1.71	.....	.....	.....	.....
October	2.4	1.8	2.09	([c])	.....	.....	.....
November	13.5	2.4	4.41	.....	.....	.....	.....
December	25.5	7.2	11.3	([d])	.....	.....	.....
1905.							
January	65.0	7.2	19.2	.....	.....	.....	.....
February	13.6	7.2	10.3	6.44	16.7	1.36	1.42
March	42	3.6	10.3	8.38	18.7	1.52	1.75
April	36.5	15.8	21.8	5.01	71.9	5.85	6.53
May	28.2	18.2	22.6	1.46	37.2	3.02	3.48
June	25.5	18.2	20.2	4.59	24.8	2.02	2.25
July	20.5	3.6	7.36	2.18	9.54	.776	.89
August	20.5	5.4	14.1	1.04	15.1	1.23	1.42
September	15.8	1.3	4.03	.069	4.10	.333	.37
October	15.8	1.3	2.98	.036	3.02	.246	.28
November	11.3	1.3	4.05	.044	4.09	.333	.37
December	42.0	3.6	14.9	1.52	16.4	1.33	1.53
The year	65.0	1.3	12.7	.....	.....	.....	.....

[a] July 19-31. [b] August 1-22. [c] Discharge October 17, 1.31 sec.-ft. [d] Discharge December 6, 3.2 sec.-ft.

Monthly discharge of Phillips Lake outlets, in Holden and Dedham, Me., for 1904-1906—Continued.

Month.	Discharge in second-feet.					Run-off.	
	Northern outlet.			Southeastern outlet.		Sec.-ft. per sq. mile.	Depth in inches.
	Maximum.	Minimum.	Mean.	Mean.	Total.		
1906.							
January	59.0	15.8	33.2	4.22	37.4	3.04	3.50
February	53.0	25.5	40.8	3.70	44.5	3.62	3.77
March	56.0	28.2	44.8	.60	45.4	3.69	4.25
April	56.0	15.8	42.6	19.2	61.8	5.02	5.60
May	53.0	25.5	39.6	30.8	70.4	5.72	6.60
June	56.0	20.5	43.0	13.9	56.9	4.63	5.17
July	50.2	9.2	16.8	.84	17.6	1.43	1.65
August	20.5	9.2	13.5	.16	13.7	1.11	1.28
September	15.8	5.4	8.65	0	8.65	.703	.78
October	23.0	2.4	7.25	0	7.25	.589	.68
November	53.0	11.3	36.5	0	36.5	2.97	3.31
December	15.8	11.3	13.4	.13	13.5	1.10	1.27
The year	59.0	2.4	28.3	6.13	34.5	2.80	37.86

NOTE.—Above values for both stations, 1904-6, are approximate, owing to local changes in conditions of flow, which could not be covered by meter measurements.

KENNEBEC RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Kennebec River is one of the best streams in the United States for the development of water power. Its basin, which lies wholly within the State of Maine, between those of the Androscoggin and the Penobscot, is 150 miles in length and from 50 to 80 miles in width in the main portion, embracing a total area of 5,970 square miles. Of this area, 1,240 square miles are tributary to Moosehead Lake, in which the river has its source. The upper tributaries, however, rise in the hilly forested areas lying to the east and west of that lake. Of these, Moose River is the most important.

Below the outlet of Moosehead Lake the hills close in on the river, forming a narrow rocky chasm, with steep and precipitous sides. From Moosehead Lake to the upper end of Indian Pond, a distance of about 4.5 miles, there is a fall of about 90 feet, this being a very rough, rocky, and turbulent part of the river. Indian Pond is a stretch of quiet water about 5 miles long, with a maximum width of one-half mile. From Indian Pond to the Forks the river is a torrent, falling in a rough and rocky bed about 350 feet in a distance of about 15 miles. Dead River is tributary to the Kennebec at the Forks. Below this junction the river flows with a lesser slope in a narrow winding bed about 20 miles to Bingham; thence through a broader valley, in which are located many farms. Between Bingham and tide water there are a number of large falls, at which water power has been developed.

For a detailed report on Kennebec River drainage, including all data available up to December, 1906, see Water-Supply Paper No. 198.

RIVER SURVEYS IN KENNEBEC DRAINAGE.

In order to point out the power and storage possibilities in the Kennebec River drainage basin, surveys have been made as follows

From tide water to Moosehead Lake, for the determination of the profile and plan of the river.

Moose River from Moosehead Lake to near Long Pond.

Surveys of Wood and Attean ponds and Brassua Lake, to determine their storage capacity.

Surveys of Holeb, Long, Lower and Middle Roach, West Carry, and Spencer ponds, and Flagstaff and Spring lakes, to determine their areas.

From the data collected by the river surveys sheets have been prepared, showing as far as available the profile of water surface, plan of the river, contours along the banks, and prominent natural or artificial features.

From the lake surveys sheets have been prepared, showing as far as possible the shore lines and bank contours, covering from 10 to 20 feet depth of storage.

The results of these surveys have been published on sheets, and may be had on application to the Director of the Geological Survey.

MOOSEHEAD LAKE AT EAST OUTLET, MAINE.

A record of gage heights of Moosehead Lake level at Moosehead Lake east outlet has been kept since April, 1895, by the Hollingsworth & Whitney Company, supplemented for a portion of this time by gage readings at Greenville, furnished for publication by this company.

These gages are cast-iron staff gages set to the same datum; that at Moosehead Lake east outlet is referred to the following bench mark: Copper bolt set in a large rock near left end of dam at elevation 18.428 of gage datum, zero of gage datum being approximately 10 feet below the gate sills and 1,011.30 feet above mean sea level. Gage readings in the following list are referred to a datum 10 feet higher, i. e., with zero at sill of gates. For gage heights previous to 1906 see Water-Supply Paper No. 198.

Daily gage height, in feet, of Moosehead Lake at East Outlet and at Greenville, Me., for 1906.

Day.	January.	February.	March.	April.	May.		June.	
	East outlet.	East outlet.	East outlet.	East outlet.	East outlet.	Greenville.	East outlet.	Greenville.
1						3.0	7.46	7.45
2	0.5	0.5		0.9	3.3	3.15		7.45
3			0.8					
4	.5			.95	3.75	4.4	7.45	7.4
5	.45	.45	.7			3.85		7.45
6				.95			7.42	7.5
7		.4	.7		4.58			7.5
8						4.6	7.4	7.4
9		.35	.7	1.0	5.05	4.9		7.4
10	.4					5.35		
11				1.0	5.9	5.75	7.4	7.5
12		.3	.7			6.0		7.5
13	.35		.75				7.4	7.5
14		.5			5.95	6.55		7.4
15	.4					6.85	7.35	7.4
16		.6	.8		7.15	7.1		7.35
17	.3			1.1		7.2		
18				1.2	7.32	7.35	7.25	7.3
19	.3	.7				7.4		7.25
20			.86				7.1	7.2
21		.7	.9			7.5		7.1
22	.25						7.0	7.1
23				1.8	7.5	7.5		7.0
24	.25		.9			7.5		
25				2.05		7.55	7.1	7.0
26	.5		.9			7.55		7.15
27		.8		2.4		7.4	7.05	7.15
28		.8	.8		7.5			7.1
29	.45					7.55	6.95	7.0
30			.8	2.88	7.45	7.6		7.0
31	.5					7.5		

Day.	July.		August.		September.		October.		November.		December.	
	East outlet.	Greenville.	East outlet.	Greenville.	East outlet	Greenville.	East outlet.	Greenville.	East outlet.	Greenville.	East outlet.	Greenville.
1	6.85		4.9	4.95		3.2		2.0		2.4		
2	6.7			4.95				2.0	2.8	2.5		
3		6.7	4.8	4.9	3.1	3.1	2.05	2.0		2.5	3.25	
4	6.55	6.55		4.8		3.1		2.0				
5		6.6			2.95	3.1	2.0	1.9	2.85	2.8		
6	6.35	6.5	4.65	4.65		3.0		1.8		2.8	3.3	3.3
7		6.35		4.65	2.85	3.0			2.9	2.9	3.3	3.3
8			4.5	4.65		3.0	1.9	1.9		2.9		
9	6.15			4.5				1.6	3.0	2.9		
10		6.1	4.35		2.75	2.9	2.1	1.9		2.9		
11	6.0	6.1		4.25		2.8		1.9				
12		6.0			2.75	2.8	2.15	1.9	3.0	2.9	3.25	
13	5.9	5.95	4.1	4.25		2.8		2.1		2.9		
14		5.9		4.2	2.50	2.8			2.9	2.9	3.2	
15			3.95	4.15		2.8	2.2			2.9		
16	5.7	5.75		4.0				2.2	3.0	2.9		
17		5.6	3.85	3.9	2.45	2.5	2.2	2.2		2.9	3.2	
18	5.6	5.7		3.85		2.5		2.2				
19		5.6			2.4	2.5	2.15	2.2	3.05	3.0	3.2	
20	5.5	5.55	3.75	3.75		2.5		2.2		3.0		
21		5.5		3.7	2.4	2.4			3.0	3.1	3.2	
22				3.65		2.2	2.10	2.2		3.0		
23	5.4	5.4		3.65				2.2	3.2	3.2		
24		5.4	3.6	3.7	2.3		2.2			3.3	3.15	
25	5.33	5.4		3.6				2.2				
26		5.35			2.2	2.1	2.5		3.3		3.3	
27	5.2		3.4	3.45		2.1		2.3		3.3		
28		5.2			2.15	2.1			3.3	3.3	3.35	
29			3.3			2.0	2.6	2.5		3.3		
30	5.0	4.45		3.2	2.1			2.4	3.3	3.3		
31		5.05	3.15	3.2			2.8	2.4				

NOTE.—Lake frozen over January 1 to May 13 and December 2 to 31.

KENNEBEC RIVER AT THE FORKS, MAINE.

This station was established September 28, 1901, at the wooden highway bridge across Kennebec River at The Forks, above the mouth of Dead River. Of the drainage area at this station, 1,240 square miles are tributary to Moosehead Lake and the remaining 330 square miles drain into the Kennebec by small streams with steep slopes and no storage. The conditions at this station and the bench marks are described in Water-Supply Paper No. 165, page 53, and in Water-Supply Paper No. 198, where are given also references to publications that contain data for previous years. Gage datum, revised during July, 1906, is 565.44 feet above mean sea level. Length of chain, formerly 17.18 feet, was changed to 17.08 feet May 8, 1906.

A measurement was made September 5, 1906, by F. E. Pressey with the following results:

Width, 124 feet; area, 799 square feet; gage height, 2.70 feet; discharge, 2,200 second-feet.

Daily gage height, in feet, of Kennebec River at The Forks, Maine, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					3.45	4.8	4.3	3.9	3.3	1.6	1.05	0.8
2					4.25	5.4	5.0	3.9	3.3	1.7	0.75	0.8
3		4.7			4.45	5.2	4.8	3.95	3.15	1.7	1.0	1.0
4					4.45	3.9	4.6	3.25	3.0	1.7	1.45	1.45
5					4.65	5.0	4.9	3.6	2.75	1.7	1.3	1.8
6	2.9				4.75	6.05	4.7	3.7	2.7	1.6	1.3	1.85
7				2.4	4.55	6.2	4.65	3.3	2.7	1.6	1.25	.....
8					3.8	5.85	4.7	3.1	2.7	1.6	1.3	.....
9			4.3		3.85	4.9	4.7	3.75	2.7	1.6	1.3	.....
10		4.7			5.1	4.95	4.9	2.9	1.8	2.25	1.6	.....
11					6.0	5.0	4.75	2.8	2.6	2.9	1.55	.....
12					4.0	5.1	4.8	2.8	2.5	3.35	1.6	3.5
13	1.8				4.05	4.7	4.65	2.75	2.65	2.65	1.6	.....
14				2.2	4.5	4.35	4.15	2.7	2.6	1.75	1.1	.....
15				2.3	4.4	4.7	4.1	3.4	2.6	0.9	1.0	.....
16			4.5	3.9	4.8	4.25	3.95	3.15	2.55	1.1	0.7	.....
17		5.5		5.15	5.95	3.95	3.65	3.0	2.5	1.2	0.6	.....
18				5.95	6.9	4.35	3.4	2.95	2.35	1.2	0.6	.....
19				4.75	6.5	4.65	3.15	2.8	2.3	1.45	0.95	.....
20	2.7			3.35	6.4	4.65	2.85	2.75	1.65	1.75	0.75	.....
21				3.25	6.4	4.65	2.75	2.7	1.4	2.0	1.0	3.0
22				3.4	6.7	4.7	2.75	2.7	1.35	2.2	1.4	.....
23				3.45	5.9	4.65	2.7	2.85	1.4	2.2	1.45	.....
24		4.6	4.5	3.3	6.75	3.8	2.55	2.9	1.4	2.3	1.4	.....
25				3.0	6.4	1.9	3.1	2.8	1.4	2.55	0.85	.....
26				3.0	5.6	2.15	3.8	2.8	1.4	2.85	0.7	.....
27				2.75	6.05	4.95	3.4	2.8	1.4	2.25	0.7	.....
28	4.6			2.7	6.2	4.6	3.4	3.35	1.4	2.0	0.7	.....
29				2.7	5.95	4.5	3.7	3.5	1.4	1.9	0.8	2.8
30				3.15	4.95	3.75	3.9	3.4	1.4	1.5	0.8	.....
31			2.9		5.35		3.9	3.4		1.25		

NOTE.—The following ice conditions prevailed during 1906: River frozen January 1 to April 19 and December 7 to 31, inclusive; the ice went out April 20. During the frozen period gage heights were taken to water surface through a hole in the ice.

The following comparative readings were taken:

Comparative ice and water readings.

Date.	Water surface.	Top of ice.	Thickness of ice.	Date.	Water surface.	Top of ice.	Thickness of ice.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*	*Feet.*
January 6	2.9	2.9	0.9	February 28	4.28	4.3	1.9
January 13	1.8	1.6	1.2	March 9	4.3	4.3	2.1
January 20	2.7	2.6	1.5	March 24	4.5	4.4	2.5
January 28 [a]	4.6	4.6	.....	April 7 [b]	2.4	1.8	.....
February 3 [a]	4.7	4.7	1.5	April 14 [c]	2.2	2.2	.....
February 10 [a]	4.7	4.7	1.7	December 12	3.5	3.2	.4
February 17 [a]	5.5	5.5	1.5	December 21	3.0	.....	.9
February 24	4.6	4.6	1.9	December 29	2.8	2.8	1.0

[a] Ice jam 1 mile long extended above and below the station January 28 to February 17.
[b] Water over top of ice; ice settled and not safe.
[c] Ice not safe.

From April to August considerable fluctuations in gage heights occur daily, due to the regulating of the flow at Indian Pond dam for the purpose of log driving. The gage heights from April 23 to August 9, inclusive, are the mean of four readings daily.

Rating table for Kennebec River at The Forks, Me., for 1901 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.60	340	1.90	1,220	3.20	2,775	5.00	6,525
.70	390	2.00	1,305	3.30	2,935	5.20	7,050
.80	445	2.10	1,395	3.40	3,100	5.40	7,590
.90	505	2.20	1,490	3.50	3,270	5.60	8,145
1.00	565	2.30	1,590	3.60	3,450	5.80	8,720
1.10	630	2.40	1,700	3.70	3,635	6.00	9,315
1.20	695	2.50	1,815	3.80	3,825	6.20	9,930
1.30	765	2.60	1,935	3.90	4,020	6.40	10,550
1.40	835	2.70	2,060	4.00	4,220	6.60	11,190
1.50	910	2.80	2,190	4.20	4,635	6.80	11,850
1.60	985	2.90	2,325	4.40	5,070	7.00	12,520
1.70	1,060	3.00	2,470	4.60	5,535		
1.80	1,140	3.10	2,620	4.80	6,020		

NOTE.—The above table is applicable only for open-channel conditions. It is based on fourteen discharge measurements made during 1901-6, and is well defined between gage heights 1.1 feet and 5 feet. Above gage height 5 feet it is based on an extension of the curves of area and mean velocity, the latter determined with the aid of Kutler's formula.

Monthly discharge of Kennebec River at The Forks, Me., for 1906.

[Drainage area, 1,570 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April (21-30)	3,180	2,060	2,640	1.68	0.69
May	12,200	3,180	7,440	4.74	5.46
June	9,930	1,220	5,720	3.64	4.06
July	6,520	1,880	4,300	2.74	3.16
August	4,120	2,060	2,740	1.75	2.02
September	2,940	800	1,610	1.03	1.15
October	3,020	505	1,270	.808	.93
November	985	340	633	.403	.45

NOTE.—Values are rated as excellent, except during the log-driving season, when they should be classed as good.

KENNEBEC RIVER NEAR NORTH ANSON, ME.

This station was established October 18, 1901. It is located 1½ miles east of North Anson and about 1 mile above the mouth of Carrabassett River. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 56, and in Water-Supply Paper No. 198, where are given also data for previous years.

Numerous measurements under ice cover have been made at this station at a section some 500 feet below the bridge, and a rating curve constructed for such conditions. For further details of winter measurements at this point and of rating curve used see Water-Supply Paper No. 187.

Considerable fluctuations in the gage heights at this station occur from about May 1 to July 31, as at The Forks, but in less marked degree, due to regulation of the flow at Indian Pond dam for log-driving purposes. The discharge during this period is a mean of the discharges corresponding to gage heights of the high and low daily periods, considering each period as lasting twelve hours.

Gage readings were made twice each day by Mrs. C. S. Benjamin, the toll collector at the bridge, until July 1; after that time by H. C. Stetson. The length of the chain was 30.13 feet January 9, 1906. The gage datum is 243.83 feet above mean sea level, as determined by the Kennebec River survey of 1904, and readjusted in 1906. The datum of the three gages is the same. The reference point is a marked point on the bottom chord of the bridge near the chain gage; elevation, 24.81 feet January 9, 1906. Elevations refer to the datum of the gage. The reference point, and hence the bridge at that point, has settled about 0.3 foot in eighteen months. The gage has been corrected several times by level during this time, however, and it is believed that no error of consequence in gage readings has resulted.

Discharge measurements of Kennebec River near North Anson, Me., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.[a]	Gage height.[b]	Thickness of ice.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Feet.*	*Feet.*	*Sec.-ft.*
January 9	Pressey and Adams	440	1,100	3.58	3.66	1.28	1,290
January 10	do	440	1,030	3.40	3.52	1.30	1,120
March 2	F. E. Pressey	445	1,140	4.26	4.40	1.97	1,590
March 3	do	445	1,050	4.08	4.25	1.98	1,380
March 30	do	447	1,180	4.77	4.93	2.26	1,600
March 30	do	447	1,200	4.80	4.96	2.26	1,660
April 11	do	450	1,210	4.70	4.75	1.95	1,690
April 11	do	450	1,240	4.70	4.75	1.95	1,710
May 10	do	325	3,000	7.06			11,700

[a] To water surface. [b] To top of ice.

Daily gage height, in feet, of Kennebec River near North Anson, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.5				6.3	5.9	4.1	3.4	3.7	2.55	3.15	2.35
2			2.4		7.1	5.85	4.3	3.45	3.6	2.5	2.95	3.95
3		2.3	2.3	2.4	7.75	6.8	4.5	3.35	3.45	2.4	2.75	
4					8.25	5.1	4.35	3.45	3.5	2.35	3.0	
5					7.4	5.0	4.2	3.35	3.4	2.3	3.05	3.85
6					8.0	5.25	3.95	3.05	3.3	2.35	2.95	3.8
7				2.7	7.5	6.75	4.2	3.0	3.3	2.45	2.75	3.7
8	2.5		2.2		6.8	7.45	4.35	2.95	3.25	2.5	2.75	3.65
9	2.4				6.4	7.1	4.4	2.95	3.25	2.5	2.75	3.45
10	2.2	2.2			7.25	6.2	4.15	3.65	3.25	4.45	2.9	

Daily gage height, in feet, of Kennebec River near North Anson, Me., for 1906—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11				2.8	9.2	6.15	3.45	3.25	3.2	4.5	2.85	
12					7.7	5.75	4.7	3.2	3.15	4.25	2.9	3.25
13			2.2		6.75	5.15	4.7	3.25	3.15	3.55	3.0	
14	2.5			2.8	6.8	5.15	4.65	3.2	3.1	3.1	2.7	
15					7.0	4.75	4.25	3.45	2.95	2.7	2.6	
16					6.5	5.0	3.9	3.45	2.85	2.65	2.4	2.75
17	2.5	2.1	2.3		6.8	4.0	3.65	3.35	2.85	2.35	2.4	
18				10.0	7.7	4.1	3.9	3.3	2.85	2.5	2.05	
19				9.5	8.05	4.15	3.8	3.25	2.85	2.5	2.2	
20	1.9		2.0	8.05	7.35	4.5	3.85	3.2	2.85	2.6	2.45	
21				6.85	7.55	4.0	3.8	3.2	2.75	3.1	2.7	
22				7.2	7.35	4.05	4.15	3.15	2.65	3.3	2.85	
23				7.85	6.35	4.05	4.3	3.15	2.5	3.35	2.85	2.95
24		2.5	2.2	7.2	6.9	4.4	4.3	3.15	2.65	3.65	2.8	
25				6.15	6.2	3.25	4.7	3.35	2.6	3.8	2.65	
26				5.85	6.5	3.4	4.25	3.15	2.55	4.9	2.55	
27	3.9		2.2	4.5	6.05	4.6	4.15	3.35	2.5	4.75	2.55	
28				5.25	7.8	4.6	3.4	3.7	2.5	4.4	2.4	
29			2.6	5.35	6.95	4.3	3.3	3.95	2.5	4.1	2.25	
30			2.7	5.55	7.35	4.3	3.15	3.95	2.45	3.75	2.3	2.85
31					6.95		3.35	3.75		3.25		

NOTE.—River frozen January 1 to April 17, and December 3 to 31, inclusive; clear of ice April 18. During the frozen period gage heights are to the bottom of ice.

Thickness of ice was measured as follows:

Thickness of ice.

Date.	Thickness of ice.	Date.	Thickness of ice.	Date.	Thickness of ice.
	Feet.		*Feet.*		*Feet.*
January 1	0.9	February 17	1.9	December 5	0.4
January 8	1.0	February 24	1.8	December 6	.6
January 9	1.3	March 2, 4, 8, 13	2.0	December 7	.7
January 10	1.4	March 17, 20	2.1	December 8	.8
January 14	1.1	March 24, 27, 29, 30	2.3	December 9	1.0
January 17	1.1	April 3, 7	2.1	December 12	1.2
January 20	1.2	April 11	2.0	December 16, 23	1.4
January 27	1.3	April 14	1.9	December 30	1.5
February 3, 10	1.5				

Backwater due to anchor ice reported December 2, and probably continued throughout the month.

Rating table for Kennebec River near North Anson, Me.

OPEN-CHANNEL CONDITIONS, 1904 TO 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	1,544	3.80	3,958	5.20	7,316	7.20	13,200
2.50	1,680	3.90	4,169	5.30	7,587	7.40	13,880
2.60	1,822	4.00	4,385	5.40	7,858	7.60	14,580
2.70	1,970	4.10	4,606	5.50	8,136	7.80	15,300
2.80	2,124	4.20	4,832	5.60	8,415	8.00	16,030
2.90	2,284	4.30	5,062	5.70	8,700	8.20	16,780
3.00	2,450	4.40	5,297	5.80	8,984	8.40	17,540
3.10	2,621	4.50	5,536	5.90	9,274	8.60	18,330
3.20	2,797	4.60	5,779	6.00	9,565	8.80	19,130
3.30	2,978	4.70	6,026	6.20	10,130	9.00	19,930
3.40	3,164	4.80	6,277	6.40	10,710	10.00	24,030
3.50	3,355	4.90	6,532	6.60	11,310		
3.60	3,551	5.00	6,790	6.80	11,920		
3.70	3,752	5.10	7,053	7.00	12,550		

[a] This table is applicable only for open-channel conditions. It is based on seven discharge measurements made during 1904–6, and the form of the 1903 curve. It is well defined below gage height 5 feet.

Rating table for Kennebec River near North Anson, Me.—Continued.

UNDER ICE COVER, 1904 TO 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	590	2.20	1,170	2.90	1,790	3.60	2,460
1.60	670	2.30	1,255	3.00	1,885	3.70	2,560
1.70	750	2.40	1,340	3.10	1,980	3.80	2,660
1.80	830	2.50	1,430	3.20	2,075	3.90	2,760
1.90	915	2.60	1,520	3.30	2,170		
2.00	1,000	2.70	1,610	3.40	2,265		
2.10	1,085	2.80	1,700	3.50	2,360		

[a] This table is applicable only for ice-cover conditions. It is based on thirteen discharge measurements during 1904–6, and is well defined between gage heights (to bottom of ice) 1.5 feet and 3.4 feet.

Monthly discharge of Kennebec River near North Anson, Me., for 1906.

[Drainage area, 2,790 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	2,760	915	1,680	0.602	0.69
February	1,430	1,080	1,240	.445	.46
March	1,610	1,000	1,220	.437	.50
April	24,000	1,340	7,120	2.55	2.84
May	20,700	9,700	13,200	4.75	5.48
June	14,100	2,887	7,100	2.54	2.83
July	6,026	2,709	4,584	1.64	1.80
August	4,277	2,367	3,057	1.09	1.26
September	3,752	1,612	2,455	.880	.98
October	6,532	1,415	2,982	1.07	1.23
November	2,709	1,131	1,966	.704	.78
December	2,810	1,479	2,032	.728	.84
The year	24,000	915	4,057	1.45	19.80

NOTE.—Values are rated as follows: January to March and December, fair; April to November, good.

KENNEBEC RIVER AT WATERVILLE, ME.

Observations of the flow of Kennebec River at Waterville have been made by Hollingsworth & Whitney Company since 1892, and furnish the longest set of continued records of flow of this river. This company manufactures manila paper, ground wood, and sulphite pulp.

The dam is of timber-crib work, the main portion having a vertical downstream face with a horizontal crest about 5.75 feet wide; the upstream slope is about 40 degrees with the horizontal. The average elevation of crest of dam, as determined by levels during July, 1906, was 119.37 of the Hollingsworth & Whitney datum, which corresponds to 71.53 of mean sea level, according to Kennebec datum, as corrected by levels of 1906. The total length of the dam is 800 feet, which includes a width of log-way of 34 feet. Flashboards are kept on the dam the greater part of the time, their average elevation at the above time being 123.73 of Hollingsworth & Whitney datum, or 75.89 of mean sea level. The crest of the dam is in fairly good condition. The leakage has never been measured, but is assumed as

100 second-feet arbitrarily. The water which flows through the canals is used through 46 wheels, most of which have been rated under practically the same head at Holyoke, the average head at Waterville being about 23 feet. Some water is wasted through the canal, through small waste gates, and over waste weirs. A small amount is used for washing and mill purposes, 100 cubic feet per second being arbitrarily added for these last two items.

Methods and diagrams for estimating the flow through the wheels and over the dam were developed by the late Sumner Hollingsworth, engineer for the company.

Observations are made at 12 o'clock noon of each day, that hour having been chosen after investigation as a time when the flow is least affected by storage of dams upstream and as giving most nearly the average for the day. When the flow of the river is less than about 3,500 second-feet, all of the water is used through the wheels.

The estimates of flow at this point are probably in error from 10 to 15 per cent on account of the manner in which the flow has been computed and the uncertainty of the constants used. During the past four or five years (up to January 1, 1906) the computations are in error from 10 to 15 per cent where flow has been computed with flashboards, owing to the assumption that the top of the boards were at elevation 124 of the Hollingsworth & Whitney datum; the results as published were too small.

These records are now being furnished by the Hollingsworth & Whitney Company, through the courtesy of their engineer, Mr. James L. Dean.

All records and estimates for this station for years prior to 1907 have been revised and republished in Water-Supply Paper No. 198.

Daily discharge, in second-feet, of Kennebec River at Waterville, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,450	3,792	2,310	4,223	20,350	16,920	7,574	5,240	3,035	1,184	3,863	2,634
2	2,339	3,591	2,553	4,470	24,520	14,430	7,288	4,753	3,041	1,794	3,541	1,075
3	2,694	3,187	2,530	4,055	25,210	15,800	7,829	4,552	4,089	2,105	2,702	2,430
4	1,992	1,528	1,244	3,965	26,380	16,380	6,500	4,286	3,667	1,842	2,711	2,214
5	1,981	2,668	2,638	4,340	25,630	14,770	7,557	3,457	3,699	1,790	3,858	1,899
6	1,809	2,624	2,595	6,743	24,980	14,920	7,768	4,630	3,719	1,810	3,278	1,928
7	633	2,016	2,039	7,897	23,770	21,450	7,626	4,219	2,654	873	2,673	1,450
8	2,908	2,006	2,776	6,924	23,100	20,350	7,133	3,657	3,419	1,836	2,662	1,413
9	2,297	1,778	2,018	7,259	20,390	21,030	7,384	3,884	1,812	1,869	2,989	1,854
10	1,346	1,663	1,623	7,296	22,770	18,150	6,939	3,884	3,481	2,154	3,032	2,713
11	1,571	1,228	1,214	6,021	34,370	18,510	7,605	4,186	3,306	9,178	2,118	2,654
12	2,112	1,747	2,550	5,835	27,760	15,520	7,412	2,159	2,999	7,152	3,804	2,727
13	1,932	2,051	2,849	6,311	20,590	19,130	8,801	3,377	1,850	5,317	3,613	2,623
14	902	2,328	2,006	6,977	22,380	14,710	8,122	3,326	3,848	3,645	3,809	2,732
15	1,612	2,068	2,244	17,180	22,020	12,920	7,218	2,993	2,939	3,873	3,272	2,703
16	2,214	2,024	1,795	39,390	18,650	11,260	6,267	3,036	1,195	2,710	3,587	[a]2,700
17	1,643	2,029	1,714	37,080	19,060	10,810	5,285	3,350	2,688	2,402	3,261	2,668
18	3,073	609	906	33,120	21,240	5,326	6,080	3,069	2,290	1,988	2,091	2,439
19	2,553	2,589	2,565	33,010	24,480	6,479	5,928	2,386	2,114	1,863	3,278	2,785
20	2,779	2,656	2,296	32,910	23,670	8,127	5,355	3,761	2,393	2,257	4,066	2,776

[a] Approximate.

Daily discharge, in second-feet, of Kennebec River at Waterville, Me., for 1906—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	1,487	2,352	1,975	28,860	20,980	7,337	5,303	3,081	2,421	1,815	4,490	2,406
22	2,805	2,569	2,288	31,370	19,980	7,378	4,357	2,783	2,131	3,959	4,490	2,350
23	2,804	2,368	1,988	32,930	18,410	8,803	5,515	3,010	901	3,672	4,734	1,870
24	8,171	2,236	1,952	28,910	17,090	12,630	5,533	3,347	2,088	3,609	4,482	3,880
25	8,208	1,505	938	22,690	14,430	11,280	5,805	3,280	1,788	3,916	3,055	2,444
26	7,833	2,887	2,056	21,210	16,890	8,161	5,286	2,291	2,081	8,360	3,800	4,105
27	6,946	2,851	1,923	18,240	20,720	5,374	4,851	3,401	1,812	8,608	3,837	3,606
28	5,899	2,865	2,465	17,160	25,210	9,272	4,666	3,445	2,071	8,068	3,827	3,543
29	5,917	.....	3,714	19,200	25,890	8,504	3,668	5,220	1,758	7,321	2,375	3,292
30	5,091	.....	4,208	20,340	20,980	7,967	3,815	4,909	588	5,678	3,543	2,125
31	3,560	.....	5,016	.....	19,080	.....	5,113	4,648	.....	5,049	.....	2,998

Monthly discharge of Kennebec River at Waterville, Me., for 1906.

[Drainage area, 4,270 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	8,210	633	3,210	0.752	0.87
February	3,790	609	2,280	.534	.56
March	5,020	906	2,290	.536	.62
April	39,400	3,960	17,200	4.03	4.50
May	34,400	14,400	22,300	5.22	6.02
June	21,400	5,330	12,800	3.00	3.35
July	8,800	3,670	6,310	1.48	1.71
August	5,240	2,160	3,660	.858	.99
September	4,090	588	2,530	.593	.66
October	9,190	873	3,800	.889	1.02
November	4,730	2,090	3,430	.803	.90
December	4,100	1,080	2,550	.597	.69
The year	39,400	588	6,860	1.61	21.89

NOTE.—For accuracy see station description.

KENNEBEC RIVER AT BINGHAM, ME.

A measurement was made September 6, 1906, from the downstream side of the highway bridge at Bingham. The bench mark is top of third floor beam from the pier, 245 feet from the end of the inclined end post, downstream side of bridge, at left bank.

Distance to water surface, 23.55 feet; width, 419 feet; area, 1,680 square feet; discharge, 2,670 second-feet.

MOOSE RIVER NEAR ROCKWOOD, ME.

This station was established September 7, 1902. It is located 4 miles west of Kineo, Me., near the village of Rockwood, and 2 miles from the mouth of the river. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 60, and in Water-Supply Paper No. 198, where are given also data for previous years.

A measurement was made November 13, 1906, by F. E. Pressey, with the following results:

Width, 232 feet; area, 630 square feet; gage height, 3.25 feet; discharge, 765 second-feet.

Daily gage height, in feet, of Moose River near Rockwood, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.8	2.3	2.1	1.5	6.7	5.85	3.75	2.6	1.9	2.1	3.9	3.0
2	1.8	2.4	2.0	1.5	6.65	5.5	3.6	2.6	1.8	2.1	3.9	3.0
3	1.8	2.4	1.9	1.5	6.85	5.2	3.5	2.5	1.85	2.1	3.9	3.0
4	1.9	2.5	1.9	1.5	7.2	5.25	3.5	2.5	1.95	2.1	3.9	3.0
5	1.9	2.5	1.9	1.5	7.55	5.35	3.4	2.4	2.0	2.1	3.8	3.0
6	1.9	2.6	1.9	1.5	7.85	5.5	3.3	.....	1.9	2.1	3.7	2.9
7	1.9	2.6	1.8	1.5	8.0	5.4	3.25	.....	1.95	2.1	3.7	2.9
8	1.9	2.6	1.8	1.5	8.0	5.3	3.2	2.3	2.0	2.1	3.6	2.9
9	1.9	2.6	1.8	1.5	8.0	5.35	3.1	2.2	2.05	2.1	3.55	[a] 2.9
10	1.8	2.6	1.9	1.5	8.2	5.5	3.1	2.2	2.1	2.1	3.4	3.0
11	1.7	2.6	1.9	1.6	8.55	5.65	3.2	2.15	2.1	2.45	3.4	3.0
12	1.7	.....	1.8	1.6	8.6	5.6	3.35	2.1	2.1	2.6	3.4	2.9
13	1.7	.....	1.8	1.7	8.5	5.55	3.45	2.0	2.1	2.6	3.3	2.9
14	1.7	.....	1.8	1.7	8.4	5.35	3.5	2.0	2.1	2.9	3.3	2.9
15	1.7	.....	1.7	1.8	8.3	5.2	3.4	1.95	2.1	3.0	3.3	2.9
16	1.7	2.4	2.7	2.0	8.2	5.35	3.4	1.9	2.1	3.0	3.2	2.8
17	1.7	2.4	1.6	2.25	8.2	5.25	3.3	1.9	2.1	3.0	3.2	2.8
18	1.7	2.3	1.6	2.45	8.3	5.05	3.3	1.85	2.1	3.0	3.2	2.8
19	1.7	2.3	1.6	2.65	8.2	4.75	3.25	1.8	2.1	3.0	3.1	2.8
20	1.7	2.3	1.6	3.05	8.2	4.5	3.2	1.8	2.1	3.0	3.1	2.7
21	1.7	2.3	1.6	3.9	8.2	4.4	3.2	1.8	2.1	3.0	3.0	2.6
22	1.7	2.2	1.6	4.8	8.1	4.45	3.1	1.8	2.1	3.0	3.0	2.6
23	.....	2.2	1.6	5.3	7.6	4.5	3.1	1.9	2.1	3.0	3.2	2.6
24	.....	2.1	1.5	5.5	7.15	4.5	3.05	1.9	2.1	3.1	3.2	2.6
25	.....	2.1	1.5	5.75	6.85	4.45	3.0	1.9	2.1	3.2	2.5	2.6
26	1.9	2.1	1.4	5.85	6.6	4.25	2.95	1.8	2.1	3.45	2.2	2.7
27	2.0	2.1	1.4	6.0	6.5	4.2	2.9	1.9	2.1	3.65	3.3	2.7
28	2.0	2.1	1.4	6.35	6.4	4.05	2.85	1.9	2.1	3.8	3.35	.....
29	2.1	.....	1.4	6.55	6.45	3.9	2.75	1.9	2.1	4.0	3.3	.....
30	2.2	.....	1.4	6.6	6.25	3.8	2.7	1.9	2.1	4.0	3.25	.....
31	2.2	.....	1.4	.....	6.05	.....	2.7	1.9	.....	4.0	.....	.....

[a] Thickness of ice at gage, 0.4 feet; 10 feet from gage, 0.3 feet.

NOTE.—There was no ice above or below the gage during the winter season, 1905-6, except some along the banks of the river 5 or 6 feet from the gage. River frozen over at gage on December 7. During December the afternoon gage height is used, as the morning height is affected by anchor ice. Open channel through ice throughout December.

Rating table for Moose River near Rockwood, Me., for 1902 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	88	2.50	414	3.60	968	5.40	2,432
1.50	108	2.60	454	3.70	1,032	5.60	2,629
1.60	130	2.70	496	3.80	1,098	5.80	2,830
1.70	154	2.80	539	3.90	1,166	6.00	3,035
1.80	180	2.90	584	4.00	1,236	6.20	3,245
1.90	208	3.00	631	4.20	1,382	6.40	3,455
2.00	238	3.10	681	4.40	1,538	6.60	3,670
2.10	270	3.20	733	4.60	1,703	6.80	3,890
2.20	303	3.30	788	4.80	1,875	7.00	4,110
2.30	338	3.40	846	5.00	2,055	8.00	5,275
2.40	375	3.50	906	5.20	2,240	9.00	6,500

NOTE.—The above table is strictly applicable only for open-channel conditions. It is based on eleven discharge measurements made during 1902-1906 and is well defined between gage heights 1.5 feet and 6.5 feet.

Monthly discharge of Moose River near Rockwood, Me., for 1906.

[Drainage area, 680 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	303	154	191	0.281	0.32
February	454	270	370	.544	.57
March	270	88	155	.228	.26
April	3,670	108	1,040	1.53	1.71
May	6,000	3,090	4,790	7.04	8.12
June	2,880	1,100	2,050	3.02	3.37
July	1,060	496	744	1.09	1.26
August	454	180	262	.388	.45
September	270	180	255	.375	.42
October	1,240	270	592	.871	1.00
November	1,170	303	826	1.21	1.35
December	631	454	548	.806	.93
The year	6,000	88	985	1.45	19.76

NOTE.—Discharge interpolated for days on which gage was not read.
Values are rated as follows: January to March and December, good; April to November, excellent.

ROACH RIVER AT ROACH RIVER, ME.

This station was established November 10, 1901. It is located near the village of Roach River. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 63, and in Water Supply Paper No. 198, where are given also data for previous years.

Daily gage height, in feet, of Roach River at Roach River, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					2.5	2.9	2.5	2.3	2.2	2.2	2.5	2.3
2					2.5	4.55	3.6	2.3	2.2	2.2	2.5	2.3
3					2.6	6.3	3.6	2.6	2.2	2.2	2.5	2.3
4					2.6	5.8	3.6	2.6	2.2	2.2	2.5	2.3
5					2.6	3.65	3.6	2.6	2.2	2.2	2.5	2.3
6					3.6	2.9	3.6	2.8	2.2	2.2	2.5	2.3
7					3.6	2.9	3.6	2.8	2.2	2.2	2.5	2.3
8					4.2	2.5	3.6	2.8	2.2	2.4	2.3	2.3
9					4.7	2.5	2.2	2.8	2.2	2.4	2.3	2.3
10					5.6	2.5	2.2	2.2	2.2	2.4	2.3	2.3
11					5.2	2.5	2.2	2.2	2.2	2.4	2.3	2.3
12					5.4	2.5	2.2	2.2	2.2	2.4	2.3	2.3
13					5.4	2.5	2.2	2.2	2.2	2.4	2.3	2.3
14					4.15	2.5	2.2	2.2	2.2	2.4	2.3	2.3
15				2.2	2.9	2.5	2.2	2.2	2.2	2.4	2.3	2.3
16				2.2	2.9	2.5	2.2	2.2	2.2	2.4	2.3	2.3
17				2.2	6.3	2.5	2.2	2.2	2.2	2.4	2.3	2.3
18				2.2	4.2	2.5	2.2	2.2	2.2	2.4	2.3	2.3
19				2.2	2.9	2.5	2.2	2.2	2.2	2.4	2.3	2.3
20				2.2	2.9	2.5	3.3	2.2	2.2	2.4	2.3	2.3
21				2.2	2.9	2.5	3.3	2.2	2.2	2.4	2.3	2.3
22				2.2	6.2	2.5	3.3	2.2	2.2	2.6	2.3	2.3
23				2.2	2.9	2.5	3.3	2.2	2.2	2.6	2.3	2.3
24				2.3	6.2	2.5	3.3	2.2	2.2	2.6	2.3	2.3
25				2.3	2.9	2.5	2.85	2.2	2.2	2.6	2.3	2.3
26				2.35	2.9	2.5	2.4	2.2	2.2	2.6	2.3	2.3
27				2.35	3.25	2.5	2.4	2.2	2.2	2.6	2.3	2.3
28				2.35	3.25	2.5	2.2	2.2	2.2	2.6	2.3	2.3
29				2.35	3.25	2.5	2.2	2.2	2.2	2.6	2.3	2.3
30				2.35	2.9	2.5	2.2	2.2	2.2	2.6	2.3	2.3
31					2.9		2.2		2.2	2.5		2.3

NOTE.—River frozen January 1 to April 15, but a small portion of the channel was open opposite the gage for the greater part of the winter season. The thickness of the ice varied from 0.2 to 0.7 foot.
Flow probably somewhat affected by ice conditions during December.

Rating table for Roach River at Roach River, Me., for 1901 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.20	46	3.10	338	4.00	730	4.90	1,170
2.30	68	3.20	379	4.10	775	5.00	1,225
2.40	94	3.30	421	4.20	820	5.20	1,335
2.50	122	3.40	463	4.30	865	5.40	1,445
2.60	153	3.50	506	4.40	915	5.60	1,555
2.70	186	3.60	550	4.50	965	5.80	1,670
2.80	221	3.70	595	4.60	1,015	6.00	1,790
2.90	258	3.80	640	4.70	1,065	6.20	1,910
3.00	298	3.90	685	4.80	1,115	6.30	1,970

NOTE.—The above table is applicable only for open-channel conditions. It is based on ten discharge measurements made during 1902-1905, and is fairly well defined.

Monthly discharge of Roach River at Roach River, Me., for 1906.

[Drainage area, 85 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April (15-30)	81	46	59.7	0.702	0.42
May	1,970	122	596	7.01	8.08
June	1,970	122	293	3.45	3.85
July	550	46	232	2.73	3.15
August	221	46	80.4	.946	1.09
September	46	46	46.0	.541	.60
October	153	46	101	1.19	1.37
November	122	68	80.6	.948	1.06
December	68	68	68.0	.800	.92

NOTE.—Values are rated as follows: April and August to December, fair; May to July, good.

DEAD RIVER NEAR THE FORKS, MAINE.

This station was established September 29, 1901. It is located 1½ miles west of The Forks. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 66, and in Water-Supply Paper No. 198, where are given also data for previous years.

Discharge measurements of Dead River near The Forks, Maine, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 8	F. E. Pressey	258	1,250	4.35	7,700
May 8	do	260	1,250	4.28	7,490
September 5	do	220	398	0.85	385

Daily gage height, in feet, of Dead River near The Forks, Maine.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		3.85	3.55	1.25	0.85	0.75	0.75	1.4	0.95
2		4.4	2.35	1.15	.85	.85	.75	1.3	.95
3		4.1	2.15	1.15	.75	.85	.75	1.25	1.05
4		4.2	1.95	1.15	.75	.8	.75	1.15	1.05
5		3.7	2.95	1.15	.75	.75	.75	1.05	1.05
6		4.35	3.05	1.15	.75	.75	.65	1.05	1.15
7		4.35	3.7	1.05	.75	.75	.65	.95	1.25
8		3.65	3.95	1.05	.65	.75	.65	.95	1.25
9		3.85	3.7	1.05	.65	.75	1.15	.95	1.25
10	2.65	3.9	2.7	1.2	.65	.75	1.4	.95	1.15

Daily gage height, in feet, of Dead River near The Forks, Maine—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec
11	2.65	4.25	3.6	1.3	0.65	0.85	1.65	1.05	1.25
12	2.55	4.75	3.95	1.65	.65	.85	1.55	1.05	1.25
13	2.45	3.95	2.5	1.8	.65	.8	1.65	.95	1.25
14	2.45	4.05	2.0	1.65	.65	.75	1.3	.95	.....
15	2.35	3.8	1.95	1.6	.65	.75	1.25	1.05	.....
16	2.6	3.85	1.6	1.35	.65	.75	1.15	1.05	.....
17	3.0	3.85	1.7	1.35	.6	.75	.95	1.05	.....
18	3.2	4.35	1.55	1.35	.55	.75	.95	1.05	.....
19	3.4	3.9	1.45	1.35	.65	.75	.9	1.05	.....
20	3.6	3.65	1.4	1.25	.65	.75	.85	1.05	.....
21	3.85	3.85	1.35	1.25	.75	.75	.85	1.15	.....
22	4.55	3.4	1.25	1.25	.75	.75	1.25	1.25	.....
23	4.65	4.0	1.5	1.25	.75	.75	1.5	1.35	.....
24	4.15	3.4	1.65	1.25	.85	.85	1.8	1.25	.....
25	3.8	3.55	2.0	1.15	.85	.85	1.85	1.15	.....
26	3.4	2.6	1.9	1.15	.85	.75	1.95	1.15	.....
27	3.0	3.0	1.8	1.05	.75	.75	2.05	1.15	.....
28	3.25	3.05	1.6	.95	.75	.75	1.9	1.05	.....
29	3.55	3.95	1.4	.95	.75	.75	1.85	1.05	.....
30	3.45	3.25	1.35	.85	.75	.65	1.7	1.05	.....
31	.....	3.15	.....	.85	.75	.....	1.55	.....	.....

NOTE.—The river was frozen from January 1 to April 10, when the ice broke up.

On February 27, 1906, cakes of ice were piled up on the shore and the river was full of cakes of ice frozen in an ice field. The ice jam extended from the mouth of the river to about 1,000 feet above the cable. Near the cable and gage the ice cakes formed drifts along the channel of the river 2 to 3 feet above the normal ice cover. There were 10 feet of open channel opposite the gage. The river at the cable was frozen entirely over. River frozen over December 14–31. The following comparative readings were made:

Comparative ice and water readings.

Date.	Midstream at gage.			Midstream at cable.	
	Water surface.	Top of ice.	Thickness of ice.	Thickness of ice.	Water surface to bottom of ice.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*
February 27	2.2	2.3	1.6	1.0	0.9
March 7	2.3	2.4	1.7	1.2	1.1
March 14	2.2	2.3	1.7	1.2	1.1
March 21	2.4	2.5	1.6	1.8	1.7
March 28	2.5	2.4	1.6	1.6	1.6
April 4	2.5	2.3	1.2	(a)	(a)

a Water over top of ice.

Rating table for Dead River near The Forks, Maine, for 1902 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
0.50	110	1.50	1,225	2.50	2,780	3.50	4,990
0.60	185	1.60	1,365	2.60	2,970	3.60	5,260
0.70	270	1.70	1,505	2.70	3,160	3.70	5,540
0.80	365	1.80	1,650	2.80	3,360	3.80	5,830
0.90	470	1.90	1,795	2.90	3,570	3.90	6,130
1.00	580	2.00	1,945	3.00	3,790	4.00	6,430
1.10	700	2.10	2,100	3.10	4,010	4.20	7,060
1.20	825	2.20	2,260	3.20	4,240	4.40	7,730
1.30	955	2.30	2,430	3.30	4,480	4.60	8,420
1.40	1,090	2.40	2,600	3.40	4,730	4.80	9,140

NOTE.—The above table is applicable only for open-channel conditions. It is based on nineteen discharge measurements made during 1903–1906, and is well defined between gage heights 0.7 foot and 2.0 feet.

Monthly discharge of Dead River near The Forks, Maine, for 1906.

[Drainage area, 870 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April (10-30)	8,600	2,520	4,590	5.27	4.12
May	8,960	2,970	5,940	6.82	7.86
June	6,280	890	2,890	2.98	3.32
July	1,650	418	867	.997	1.15
August	418	148	292	.336	.39
September	417	227	337	.387	.43
October	2,020	227	934	1.07	1.23
November	1,090	525	701	.806	.90
December (1-13)	890	525	756	.869	.42

NOTE.—Values are rated as follows: April to September, good; October to December, excellent.

CARRABASSETT RIVER AT NORTH ANSON, ME.

This station was established October 19, 1901. It is located above Embden Brook and below Anson Brook. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 68, and in Water-Supply Paper No. 198, where are given also data for previous years. Length of chain after September 7, 1906, 36.63 feet.

A measurement was made September 7, 1906, by F. E. Pressey, with the following results:

Width, 94 feet; area, 74 square feet; gage height, 0.06 feet; discharge, 107 second-feet.

Daily gage height, in feet, of Carrabassett River at North Anson, Me., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.9	3.0	1.5	0.5	1.1	0.3	0.1	0.9	0.9
2	2.7	4.0	1.4	.5	1.0	.2	.0	.8	.4
3	2.4	3.5	1.7	.6	.7	.3	.0	.8	.9
4	2.3	3.8	1.7	.6	.5	.6	.2	.8	1.1
5	2.5	3.5	1.4	.7	.4	.5	.2	.7	1.3
6	3.0	3.1	1.3	.7	.4	.3	.3	.7	1.4
7	3.3	3.2	2.0	.9	.3	.1	.4	.6	1.4
8	2.9	2.8	1.9	.7	.2	.1	.2	.7	1.5
9	2.8	2.3	1.8	.6	.1	.1	.5	.5	1.3
10	2.9	4.1	1.8	.9	.2	.2	4.0	.5	1.1
11	2.7	3.6	1.4	.8	.1	.4	3.1	.5	1.0
12	2.5	2.7	1.2	1.6	.1	.2	2.2	.6	.9
13	2.4	2.3	1.3	1.2	.1	.1	1.5	.6	1.0
14	2.3	2.6	1.1	1.0	.0	.0	1.1	.6	.9
15	3.0	1.9	.8	.8	.2	.1	.9	.5	.9
16	5.1	1.8	.7	.6	.0	−.1	.8	.6	.9
17	5.5	1.8	.6	.5	.0	−.1	.7	.7	.9
18	5.1	2.2	.6	.5	.0	.0	.5	.6	.9
19	4.8	2.2	.7	.7	.0	.0	.5	.7	1.0
20	4.8	2.1	.6	.5	.0	.0	.6	1.4	1.0
21	4.8	1.5	.6	.4	.0	.0	.8	1.2	1.1
22	4.9	1.4	.3	.9	.5	−.1	.7	1.2	1.4
23	5.1	1.3	.4	.7	.3	.0	.8	1.2	1.8
24	3.4	1.3	2.3	1.3	.3	.1	.7	1.1	2.1
25	2.8	1.3	1.8	1.0	.3	.0	.7	1.1	1.9
26	2.7	1.8	1.3	.7	.2	−.1	3.5	1.1	1.9
27	2.6	1.8	1.2	.6	.1	.0	2.4	.9	1.8
28	2.5	3.2	.7	.4	1.7	.0	2.2	.8	1.8
29	2.8	3.0	.6	.4	.9	.0	2.1	1.0	1.8
30	3.3	2.3	.6	.3	.5	.0	1.6	.6	1.7
31	.....	1.8	.....	1.7	.4	.....	1.1	.....	1.5

NOTE.—River frozen January 1 to April 16, when ice broke up; river clear of ice April 18.

Rating table for Carrabassett River near North Anson, Me., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
−0.10	77	1.10	595	2.30	1,660	4.00	3,750
.00	92	1.20	675	2.40	1,795	4.20	4,020
.10	110	1.30	755	2.50	1,900	4.40	4,290
.20	133	1.40	840	2.60	2,010	4.60	4,560
.30	160	1.50	925	2.70	2,120	4.80	4,830
.40	193	1.60	1,015	2.80	2,235	5.00	5,100
.50	233	1.70	1,105	2.90	2,350	5.20	5,370
.60	280	1.80	1,195	3.00	2,470	5.40	5,640
.70	335	1.90	1,290	3.20	2,710	5.60	5,910
.80	395	2.00	1,385	3.40	2,955		
.90	455	2.10	1,485	3.60	3,210		
1.00	520	2.20	1,585	3.80	3,480		

NOTE.—The above table is applicable only for open-channel conditions. It is the same as the 1905 table above gage height 1 foot. Below gage height 1 foot it is based on one measurement made during 1905, and probably represents closely the conditions of flow as they existed during that year.

Monthly discharge of Carrabassett River at North Anson, Me., for 1906.

[Drainage area, 340 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April[a]	5,780	1,660	2,980	8.75	9.76
May	3,880	755	1,960	5.77	6.65
June	1,660	160	708	2.08	2.32
July	1,100	160	389	1.14	1.31
August	1,100	92	215	.632	.73
September	280	77	119	.350	.39
October	3,750	92	774	2.28	2.63
November	840	233	408	1.20	1.34
December	1,480	193	759	2.23	2.57

[a] Open-channel rating was applied April 1 to 18 which probably gave daily discharges somewhat in excess of their true values.

NOTE.—Values are rated as follows: April, August, September, and December fair; remainder of period good.

SANDY RIVER NEAR MADISON, ME.

This station was established March 23, 1904, by F. E. Pressey. It is located at the dam of the Madison Electric works, just over the town line in Stark, but is nearer the Madison post-office. The conditions at the station and the bench marks are described in Water-Supply Paper No. 165, page 71, and in Water-Supply Paper No. 198, where are given also data for previous years.

Daily discharge, in second-feet, of Sandy River near Madison, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Oct.	Nov.	Dec.
1	231	539	593	1,223	2,458	2,478	.....	244	396
2	231	467	595	1,292	2,761	2,353	.....	266	194
3	200	374	517	1,050	2,252	3,747	.....	312	246
4	229	372	363	1,141	2,252	3,203	.....	397	339
5	263	361	444	1,711	1,609	2,312	.....	322	304
6	286	407	360	2,882	2,974	2,166	.....	243	279
7	236	491	339	2,985	2,901	3,219	.....	206	359
8	286	595	326	2,243	2,741	2,994	.....	213	373
9	373	555	303	2,371	2,607	3,391	.....	213	393
10	429	564	321	2,280	4,050	2,788	346	256	270

Daily discharge, in second-feet, of Sandy River near Madison, Me., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Oct.	Nov.	Dec.
11	304	478	182	1,727	3,584	2,520	933	329	304
12	351	565	294	1,748	2,780	2,067	516	295	304
13	339	698	229	1,862	2,576	1,536	310	311	339
14	294	582	406	2,813	2,830	1,202	216	334	304
15	229	442	453	6,018	2,124	906	140	300	281
16	317	373	384	8,844	1,757	688	127	300	324
17	491	296	320	8,497	1,629	656	113	369	259
18	555	208	222	7,304	1,902	601	99	381	282
19	530	274	252	6,312	2,246	601	91	492	271
20	469	273	262	5,972	1,720	594	108	983	222
21	418	274	192	4,954	1,502	497	204	919	260
22	406	294	183	5,791	1,174	638	264	743	489
23	715	327	159	4,840	974	1,556	169	871	591
24	2,655	419	166	3,319	868	4,212	154	635	482
25	2,540	423	144	2,620	944	3,089	368	477	544
26	1,736	361	191	2,574	565	2,355	1,614	479	459
27	1,505	442	252	2,274	4,280	1,338	806	667	435
28	1,000	504	443	2,321	4,787	890	804	583	405
29	732	.....	1,070	2,503	5,082	677	711	428	353
30	627	.....	1,388	2,504	3,611	608	516	303	350
31	567	.....	1,406	.....	2,607	.....	335	.....	306

NOTE.—Flashboards 1.33 feet high were used for two-thirds of the length of the dam May 5 to June 30. From July 1 to October 9 repairs of dam and construction of a log way were in progress and no records are available.

Monthly discharge of Sandy River near Madison, Me., for 1906.

[Drainage area, 650 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	2,660	200	630	0.969	1.12
February	698	208	427	.657	.68
March	1,410	144	412	.634	.73
April	8,840	1,050	3,470	5.34	5.96
May	5,080	565	2,460	3.78	4.36
June	4,210	497	1,860	2.86	3.19
October (10-31)	1,610	91	407	.626	.51
November	983	206	429	.660	.74
December	591	194	346	.532	.61

NOTE.—During February to March the values of monthly discharge are only approximate, owing to accumulation of ice on dam crest. During the remainder of the period discharges under about 500 second-feet vary from good to approximate; above 500 second-feet they are good.

COBBOSSEECONTEE STREAM AT GARDINER, ME.

Records of the flow of Cobbosseecontee Stream have been kept at the plant of the Gardiner Water Power Company since 1890, and these records have been furnished to the Survey by S. D. Warren & Co., through Mr. Joseph A. Warren.

The dam, which is the uppermost of eight on the last three-fourths mile of the river just before it enters the Kennebec, is of stone masonry with a timber apron at the toe. The downstream face has an approximate slope of one horizontal to four vertical. The crest is horizontal and is about 6 feet wide. The upstream slope is about one vertical to eight horizontal. The total length of the dam is about 100 feet, and flashboards 4.5 feet high are maintained continuously. The total head obtained is about 10 feet. The head-bay entrance is on

the right bank and from this runs a wooden penstock in which is situated a 39-inch Hercules wheel. In the head bay there is also a gatehouse with two gates which are kept partially open most of the time to regulate the proper flow down the river.

The records of flow are made up by considering:

(1) The flow over the dam—which is nothing except usually for a short time in the spring.

(2) The flow through the gates, which is regulated by means of tables drawn up for the company by Hiram F. Mills, showing the discharge through the two gates for different pond levels. The practical application of this method is to obtain a given flow at any time by setting these gates at the required gate opening, taking into account the flow through the wheel.

(3) The flow through the 39-inch wheel, which is ascertained from this gate opening and pond level, a table also being provided for this purpose by Mr. Mills.

The water pumped for the Gardiner supply is neglected in computations, being a small percentage of the flow. It is also assumed that the tail-water level remains constant. The leakage by the dam was measured during 1905 and found to be 10 second-feet. Since that time records have been corrected accordingly. On Sundays and legal holidays gates are closed and no water is allowed to run unless the lake is full.

It is considered that the estimates of flow at this point are ordinarily correct within 5 per cent. The very low water estimates may be in error as much as 10 per cent or more.

The conditions at this station are described in Water-Supply Paper No. 165, page 74, and in Water-Supply Paper No. 198, where are given also data for previous years.

Daily discharge, in second-feet, of Cobbosseecontee Stream at Gardiner, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	195	220	260	10	795	1,100	440	735	285	280	280	275
2	195	230	260	270	722	1,080	600	780	10	280	280	10
3	195	250	260	270	724	1,020	670	380	285	280	280	275
4	195	250	10	270	724	860	660	300	285	280	10	275
5	195	250	270	270	592	650	360	10	285	280	280	275
6	195	255	265	270	294	510	300	290	285	280	280	275
7	10	265	270	270	300	630	285	290	285	10	280	275
8	195	265	270	10	582	645	10	290	285	280	280	275
9	195	265	270	270	567	620	290	285	10	280	280	10
10	195	265	270	270	545	610	275	285	290	280	280	275
11	195	10	10	610	535	585	275	285	290	280	10	275
12	195	265	270	625	381	460	275	10	290	280	280	275
13	195	265	270	625	320	350	275	285	290	280	280	275
14	10	265	270	625	290	346	275	285	290	10	280	270
15	210	265	270	625	290	310	10	285	290	280	280	270
16	210	265	270	1,010	290	290	275	285	10	280	280	10
17	210	280	270	1,049	285	16	275	285	290	280	280	270
18	210	10	10	757	280	290	275	285	290	280	10	270
19	210	280	270	516	280	290	275	10	290	280	280	270
20	210	280	270	547	10	280	275	285	290	280	280	270

Daily discharge, in second-feet, of Cobbosseecontee Stream at Gardiner, Me., for 1906.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	10	280	270	677	280	280	275	290	290	10	280	270
22	210	280	270	800	280	280	10	290	290	280	280	270
23	210	280	270	800	280	280	275	290	10	280	280	10
24	303	270	270	800	280	260	720	290	280	280	280	270
25	303	10	10	1,040	275	985	910	290	280	280	10	10
26	284	260	270	1,026	275	1,280	880	10	280	280	280	270
27	284	260	270	1,051	10	1,160	760	290	280	280	275	270
28	250	260	270	1,061	310	980	450	290	280	10	275	270
29	236	.....	270	1,000	717	310	15	285	280	280	160	270
30	216	.....	270	867	970	324	400	285	10	280	275	10
31	210	.....	270	.....	1,110	.....	640	285	.....	280	.....	270

NOTE.—Leakage of dam taken at 10 second-feet, as determined by measurements during 1905.

Monthly discharge of Cobbosseecontee Stream at Gardiner, Me., for 1906.

[Drainage area, 240 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	303	10	198	0.825	0.95
February	280	10	236	.983	1.02
March	270	10	235	.979	1.13
April	1,060	10	610	2.54	2.83
May	1,110	10	436	1.82	2.10
June	1,280	16	569	2.37	2.64
July	910	10	377	1.57	1.81
August	780	10	285	1.19	1.37
September	290	10	240	1.00	1.12
October	280	10	245	1.02	1.18
November	280	10	240	1.00	1.12
December	275	10	221	.921	1.06
The year	1,280	10	324	1.35	18.33

NOTE.—For accuracy see station description.

ANDROSCOGGIN RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Androscoggin River is formed by the junction of Magalloway River and the outlet of the Umbagog-Rangeley lakes, near the Maine-New Hampshire boundary line. For about 35 miles it flows southward into the State of New Hampshire, then turns abruptly to the east and flows into the State of Maine, then turns to the south and joins the Kennebec in Merrymeeting Bay. The last fall on the Androscoggin is at Brunswick, Me., above which place the drainage area is 3,470 square miles, about 80 per cent of this being in Maine. The greatest length of the basin is 110 miles, the greatest width 70 miles, while the river itself measures about 200 miles in length from the sources of Magalloway River to the coast. The drainage areas of the river and of some of its chief tributaries are given in Water-Supply Paper No. 165, page 75.

RIVER SURVEYS IN ANDROSCOGGIN DRAINAGE.

In order to point out the power and storage possibilities in the Androscoggin River drainage basin, surveys have been made as follows: A survey for the determination of the profile only was made from tide-water to Livermore Falls. A survey for the determination of the profile and plan of the river has been made from Livermore Falls to Errol dam at the outlet of Umbagog Lake.

From the data collected, sheets have been prepared showing, as far as available, profile of water surface, plan of the river, contours along the banks, and prominent natural or artificial features. The results of these surveys have been published on sheets and may be had on application to the Director of the Geological Survey.

ANDROSCOGGIN RIVER AT SHELBURNE, N. H.

This station was established May 30, 1903. It is located at the steel highway bridge about one-half mile north of the railway station at Shelburne, N. H. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 76, where are given also references to publications that contain data for previous years. Length of chain on April 30, 1906, was 20.67 feet.

Discharge measurements of Androscoggin River at Shelburne, N. H., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 30	T. W. Norcross	394	1,730	5.98	5,100
June 5	F. E. Pressey	394	1,920	6.18	6,110
August 23	G. M. Brett	390	966	4.12	1,600

Daily gage height, in feet, of Androscoggin River at Shelburne, N. H., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.85	.....	4.05	6.4	6.9	4.7	4.1	4.1	4.1	4.05	4.15
2	.....	5.45	.....	4.15	6.3	7.0	4.65	4.1	4.0	4.1	4.0	5.7
3	.....	.....	.....	4.2	6.4	7.0	4.6	4.1	4.2	4.1	3.95	6.4
4	.....	.....	5.8	4.15	6.2	6.6	4.6	4.15	4.1	4.15	3.9	6.85
5	.....	.....	.....	4.1	6.5	6.2	4.7	3.6	4.1	4.1	4.0	.....
6	.....	.....	.....	4.05	6.4	6.3	4.55	4.05	4.2	4.1	4.0	.....
7	6.3	.....	.....	4.05	6.7	6.95	4.5	4.2	4.1	4.1	3.95	.....
8	.....	.....	.....	3.9	6.7	6.9	4.4	4.1	4.15	4.1	3.95	.....
9	.....	.....	.....	4.05	7.05	6.7	4.5	4.2	4.05	4.1	4.0	6.8
10	.....	.....	.....	4.0	7.55	6.5	4.4	4.2	4.2	4.15	4.15	.....
11	.....	6.9	5.7	4.05	7.25	6.5	4.4	4.1	4.15	4.15	4.2	.....
12	.....	.....	.....	3.95	6.95	6.35	4.35	3.7	4.1	4.1	4.1	.....
13	.....	.....	.....	4.05	7.8	6.05	4.3	4.1	4.1	4.0	4.05	.....
14	6.2	.....	.....	4.05	7.5	5.8	4.25	4.1	4.1	3.95	4.1	.....
15	.....	.....	.....	5.05	7.15	5.65	3.9	4.2	4.1	4.05	4.2	.....
16	.....	.....	.....	5.75	7.0	5.6	4.2	4.1	4.0	4.05	4.2	7.2
17	.....	.....	.....	5.8	7.05	5.5	4.3	4.2	4.0	4.15	4.2	.....
18	.....	6.8	5.7	5.85	7.0	5.4	4.2	4.2	4.1	4.1	4.1	.....
19	.....	.....	.....	5.85	7.5	5.3	4.3	3.5	4.05	4.0	4.2	.....
20	.....	.....	.....	5.85	7.4	5.2	4.3	4.4	4.1	4.0	4.15	.....

Daily gage height, in feet, of Androscoggin River at Shelburne, N. H., for 1906—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	6.25	.....	.....	6.35	7.2	5.2	4.2	4.25	4.0	4.0	4.1	.....
22	.....	.....	.....	6.45	7.0	5.05	3.75	4.2	4.1	4.1	4.1	.....
23	7.1	.....	.....	6.35	6.8	5.2	4.05	4.1	4.0	4.0	4.05	7.05
24	7.9	.....	.....	5.95	6.6	5.8	4.2	4.1	4.1	4.0	4.05	.....
25	7.3	6.9	5.4	5.85	6.9	5.5	4.2	4.1	4.0	4.2	3.95	.....
26	6.35	.....	.....	5.7	7.6	5.1	4.3	3.6	4.1	4.1	4.05	.....
27	5.7	.....	.....	5.75	8.1	5.0	4.2	4.45	4.1	4.1	4.05	.....
28	4.85	.....	.....	6.05	8.3	4.9	4.15	4.75	4.0	4.0	4.0	.....
29	5.2	.....	4.6	5.75	7.7	4.8	3.5	4.45	4.05	4.1	4.15	.....
30	5.1	.....	4.45	6.1	7.3	4.8	4.05	4.1	3.95	4.0	4.25	6.9
31	4.75	.....	4.35	.....	7.0	.....	4.05	4.15	.....	4.0	.....	.....

NOTE.—The following ice conditions prevailed during 1906: River frozen over January 1 to 23; clear of ice January 24 to February 2; frozen over February 3 to March 28; clear of ice the afternoon of March 29. River frozen over December 5 to 31. During the frozen period gage heights were taken to water surface through a hole cut in the ice. The following comparative readings were taken:

Comparative ice and water readings.

Date.	Water surface.	Top of ice.	Thickness of ice.	Date.	Water surface.	Top of ice.	Thickness of ice.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*	*Feet.*
January 7	6.3	6.5	0.95	March 11	5.7	5.95	1.05
January 14 [a]	6.2	6.35	1.25	March 18 [d]	5.7	5.85	1.45
January 21	6.25	6.4	1.3	March 25 [d]	5.4	5.6	1.65
January 23 [b]	7.1	.....	.....	March 29 [e]	4.6	.....	.....
February 11 [c]	6.9	6.95	.85	December 2-4 [e]	.....	.....	.....
February 18	6.8	6.9	1.05	December 9	6.8	7.0	.8
February 25 [b]	6.9	.....	.....	December 16 [g]	7.2	.....	.....
March 4 [d]	5.8	5.9	.8	December 23	7.05	7.4	1.5
				December 30	6.9	7.1	1.4

[a] Left channel partly open.
[b] Water flowing over ice.
[c] Possible backwater from ice jam 1,000 feet below gage. About 6 inches of snow on ice.
[d] Left channel open.
[e] River open at gage; one reading.
[f] Backwater due to anchor ice below gage.
[g] Water about 1 foot deep flowing over ice.

Rating table for Androscoggin River at Shelburne, N. H., for 1903 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.50	740	4.70	2,290	5.90	4,970	7.10	8,240
3.60	820	4.80	2,480	6.00	5,225	7.20	8,530
3.70	905	4.90	2,680	6.10	5,480	7.30	8,830
3.80	998	5.00	2,890	6.20	5,740	7.40	9,130
3.90	1,100	5.10	3,105	6.30	6,000	7.50	9,430
4.00	1,212	5.20	3,325	6.40	6,265	7.60	9,730
4.10	1,336	5.30	3,545	6.50	6,535	7.70	10,030
4.20	1,472	5.40	3,775	6.60	6,810	7.80	10,330
4.30	1,618	5.50	4,005	6.70	7,090	7.90	10,630
4.40	1,774	5.60	4,240	6.80	7,375	8.00	10,930
4.50	1,938	5.70	4,480	6.90	7,660	8.30	11,860
4.60	2,110	5.80	4,725	7.00	7,950	.....	.....

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-1906 and is well defined between gage heights 4.3 feet and 7.7 feet.

Monthly discharge of Androscoggin River at Shelburne, N. H., for 1906.

[Drainage area, 1,500 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April	6,400	1,100	3,270	2.18	2.43
May	11,900	5,740	8,200	5.47	6.31
June	7,950	2,480	4,970	3.31	3.69
July	2,290	740	1,620	1.08	1.24
August	2,380	740	1,390	.927	1.07
September	1,470	1,160	1,310	.873	.97
October	1,470	1,160	1,300	.867	1.00
November	1,540	1,100	1,310	.873	.97

NOTE.—Values are rated as follows: April to June, good; July to November, fair, owing to measurement of August 23 indicating a possible change in conditions of flow.

ANDROSCOGGIN RIVER AT RUMFORD FALLS, ME.

The discharge of Androscoggin River at Rumford Falls since 1892 has been computed by Charles A. Mixer, resident engineer of the Rumford Falls Power Company. These statistics are obtained by adding the actual measured quantities passing through the wheels to the computed flow over the dam, using the customary Francis weir formula with modified coefficient. A view of the upper and lower dams is shown in Pl. IV. The conditions at the station are described in Water-Supply Paper No. 165, page 80, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Androscoggin River at Rumford Falls, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,861	2,582	1,459	1,863	8,285	8,089	3,760	2,221	1,683	1,419	1,560	1,610
2	1,842	2,384	1,524	1,684	7,864	8,412	3,379	1,990	1,529	1,423	1,514	987
3	1,637	1,850	1,579	1,832	7,523	8,484	3,124	1,879	1,359	1,467	1,429	918
4	1,673	1,808	1,486	1,903	8,018	7,160	2,252	1,813	2,082	1,426	1,429	1,078
5	1,839	1,805	1,277	2,384	7,603	6,272	3,068	1,675	2,137	1,421	1,294	1,096
6	1,982	1,970	1,471	3,142	7,819	6,196	2,927	1,703	1,848	1,513	1,380	1,207
7	1,794	1,850	1,378	2,697	7,493	9,157	2,578	1,867	1,680	1,448	1,348	1,222
8	1,663	1,857	1,368	2,428	7,502	8,086	2,128	1,887	1,618	1,528	1,403	1,192
9	1,638	1,835	1,352	2,485	7,888	7,924	2,371	1,779	1,548	1,670	1,365	1,156
10	1,492	1,844	1,278	2,364	11,312	7,467	2,511	1,767	1,540	3,328	1,430	1,102
11	1,602	1,846	1,200	2,270	10,202	7,342	3,071	1,715	1,590	2,885	1,370	1,252
12	1,636	1,734	1,154	2,366	8,463	6,740	2,811	1,649	1,500	2,266	1,454	1,203
13	1,727	1,855	1,235	2,480	9,803	5,953	2,430	1,518	1,473	2,066	1,567	1,238
14	1,738	1,784	1,186	3,366	9,956	5,215	2,186	1,605	1,461	1,939	1,435	1,266
15	1,611	1,788	1,186	5,993	8,804	4,671	1,908	1,473	1,406	1,892	1,403	1,284
16	1,779	1,732	1,162	11,513	7,922	4,393	1,630	1,454	1,373	1,913	1,505	1,266
17	1,847	1,769	1,150	10,085	8,043	4,141	2,200	1,442	1,340	1,848	1,484	1,292
18	1,840	1,689	1,141	9,009	8,541	6,387	2,695	1,467	1,402	1,799	1,373	1,432
19	1,779	1,661	1,111	8,716	9,476	5,466	2,195	1,368	1,335	1,758	2,060	1,346
20	1,747	1,784	1,186	9,033	8,419	4,625	1,986	1,208	1,326	1,959	2,855	1,326
21	1,731	1,724	1,136	9,421	7,194	4,059	2,246	1,910	1,299	2,230	2,406	1,340
22	2,027	1,845	1,148	10,961	7,214	3,658	2,424	1,690	1,403	2,009	2,238	1,404
23	3,612	2,043	1,129	9,960	7,079	4,122	2,353	1,576	1,433	1,715	2,187	1,498
24	7,749	1,913	1,164	7,254	6,654	7,243	2,308	1,611	1,516	1,628	1,842	1,404
25	4,908	1,788	1,115	6,191	7,843	6,746	2,114	1,660	1,582	2,275	1,638	1,378
26	3,636	1,653	1,050	5,564	9,851	5,111	2,146	1,500	1,506	3,248	1,233	1,217
27	3,296	1,772	1,225	5,802	11,274	4,442	1,957	2,046	1,454	2,540	1,888	1,393
28	3,142	1,578	1,598	6,167	15,443	4,008	1,899	3,579	1,428	2,223	1,859	1,420
29	2,846	.....	2,318	6,410	14,310	3,684	1,738	2,707	1,519	2,112	1,399	1,461
30	2,548	.....	2,330	7,003	10,158	3,668	2,070	2,012	1,391	1,862	1,239	1,417
31	2,551	.....	2,138	.....	8,460	.....	2,595	1,754	.....	1,637	.....	1,362

Monthly discharge of Androscoggin River at Rumford Falls, Me., for 1906.

[Drainage area, 2,090 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	7,750	1,490	2,350	1.12	1.29
February	2,580	1,580	1,850	.885	.92
March	2,330	1,050	1,360	.651	.75
April	11,500	1,680	5,410	2.59	2.89
May	15,400	6,650	8,920	4.27	4.92
June	9,160	3,660	5,960	2.85	3.18
July	3,760	1,630	2,420	1.16	1.34
August	3,580	1,210	1,790	.856	.99
September	2,140	1,300	1,530	.732	.82
October	3,330	1,420	1,950	.933	1.08
November	2,860	1,230	1,620	.775	.86
December	1,500	918	1,280	.612	.71
The year	15,400	918	3,040	1.45	19.75

ANDROSCOGGIN RIVER AT DIXFIELD, ME.

This station was established August 22, 1902. It is located about one-half mile west of Dixfield, at the highway bridge on the road to West Peru. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 82, where are given also references to publications that contain data for previous years.

Discharge measurements of Androscoggin River at Dixfield, Me., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 3	F. E. Pressey	496	3,220	10.24	9,250
June 7	do	487	2,970	9.71	7,140
September 10[a]	H. K. Barrows	356	1,130	7.64	1,620

[a] By wading in two channels.

Daily gage height, in feet, of Androscoggin River at Dixfield, Me., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.9	10.0	.....	.....	10.45	10.45	9.15	8.3	7.8	7.75	7.85	7.8
2	8.1	.....	.....	7.8	10.45	10.4	9.0	8.2	7.8	7.75	7.8	7.4
3	[a]8.6	.....	9.3	8.0	10.4	10.6	8.75	8.05	7.75	7.7	7.8	7.65
4	[a]10.25	.....	.....	8.0	10.2	10.25	8.5	8.0	8.05	7.8	7.85	[b]8.4
5	[a]9.7	.....	.....	8.2	10.2	9.95	8.75	8.0	8.2	7.75	7.8	[b]8.5
6	[a]9.05	.....	.....	8.6	10.3	9.7	8.65	7.85	8.05	7.7	7.8	.....
7	8.4	.....	.....	8.8	10.25	10.5	8.45	7.95	7.95	7.75	7.7	.....
8	8.7	10.6	9.1	8.4	10.2	10.6	8.25	8.0	7.85	7.9	7.7	8.7
9	.....	.....	8.9	8.4	10.35	10.4	8.35	8.0	7.9	7.85	7.8	8.7
10	[c]8.9	.....	.....	8.25	11.3	10.4	8.55	8.0	7.8	8.75	7.75	.....
11	.....	.....	8.9	8.15	11.0	10.2	8.8	8.0	7.9	8.8	7.7	.....
12	.....	.....	.....	8.3	10.5	10.1	8.8	7.85	7.85	8.3	7.8	.....
13	[c]8.9	.....	.....	8.3	10.7	9.85	8.45	7.9	7.8	8.1	8.0	.....
14	.....	.....	.....	8.85	10.95	9.6	8.25	7.9	7.8	8.15	7.85	.....
15	.....	.....	.....	9.5	10.6	9.4	8.15	7.75	7.7	7.95	7.75	.....
16	.....	.....	.....	11.45	10.4	9.25	8.0	7.75	7.75	8.15	7.85	8.6
17	.....	10.2	8.6	11.3	10.3	9.25	8.15	7.75	7.65	8.1	7.75	.....
18	.....	.....	.....	11.0	10.5	9.65	8.55	7.75	7.7	8.05	7.85	.....
19	.....	.....	.....	10.85	10.65	9.7	8.3	7.7	7.7	8.0	7.75	.....
20	9.1	.....	.....	10.75	10.4	9.45	8.05	7.8	7.65	8.05	8.1	.....

[a] Ice in channel causes the high water.
[b] Anchor ice causes back water.
[c] To top of ice about 0.3 foot thick.

Daily gage height, in feet, of Androscoggin River at Dixfield, Me., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21				10.9	10.2	9.25	8.3	8.0	7.7	8.4	8.35	.....
22				11.2	10.15	9.0	8.55	8.0	7.7	8.2	8.3	.....
23	14.1			11.15	10.1	9.2	8.4	7.9	7.85	8.1	8.25	8.7
24	[a]15.05	9.3	8.0	10.55	10.05	10.3	8.3	7.9	7.75	7.95	8.15	.....
25	14.25			10.05	10.15	10.2	8.1	7.9	7.8	8.05	8.05	.....
26	13.05			9.8	10.8	9.6	8.05	7.8	7.8	9.05	7.95	.....
27	12.65			9.75	10.95	9.35	8.0	7.75	7.8	8.55	7.95	.....
28	11.45	9.3		9.75	12.3	9.15	8.0	8.9	7.7	8.40	7.95	.....
29			8.5	9.95	12.15	8.95	7.95	8.6	7.75	8.2	7.9	.....
30			8.5	10.1	11.15	8.95	7.9	8.2	7.75	8.15	[b]7.7	8.8
31			8.3		10.6		8.5	7.95		8.0		

[a] Ice jam below, open at gage. [b] Anchor ice running.

NOTE.—The following ice condition prevailed during 1906: River open January 1 to 8; frozen over at gage January 9 to January 23; open at gage January 24 to 28; frozen over January 29 to March 28; open at gage March 29; clear of ice about April 1; frozen over December 6 to 31. During the frozen period gage heights were taken to the water surface through a hole in the ice. The following comparative readings were taken:

Comparative ice and water readings.

Date.	Water surface.	Top of ice.	Thickness of ice.	Date.	Water surface.	Top of ice.	Thickness of ice.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*	*Feet.*
January 20	9.1	9.2	0.5	March 9	8.9	8.9	0.8
January 23	14.1	14.1	.....	March 11	8.9	8.9	.8
February 1	10.0	10.3	.8	March 17	8.6	8.7	.75
February 8	10.6	10.7	1.1	March 24	8.0	8.1	.6
February 17	10.2	10.3	.6	December 8	8.7	9.0	.7
February 24	9.3	9.3	.5	December 9	8.7	9.0	.7
February 28	9.3	9.3	.5	December 16	8.6	8.6	1.1
March 3	9.3	9.4	.7	December 23	8.7	8.8	1.4
March 8	9.1	9.1	.8	December 30	8.8	8.9	1.2

Rating table for Androscoggin River at Dixfield, Me., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
7.70	1,660	8.80	3,970	9.90	7,870	11.00	12,800
7.80	1,790	8.90	4,270	10.00	8,280	11.10	13,300
7.90	1,940	9.00	4,580	10.10	8,700	11.20	13,810
8.00	2,100	9.10	4,900	10.20	9,130	11.40	14,840
8.10	2,280	9.20	5,230	10.30	9,560	11.60	15,880
8.20	2,480	9.30	5,580	10.40	10,000	11.80	16,940
8.30	2,690	9.40	5,940	10.50	10,450	12.00	18,000
8.40	2,910	9.50	6,310	10.60	10,900	12.20	19,060
8.50	3,150	9.60	6,690	10.70	11,360	12.40	20,130
8.60	3,410	9.70	7,080	10.80	11,830		
8.70	3,680	9.80	7,470	10.90	12,310		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 12 discharge measurements made during 1903–1906 and is well defined below gage heights 11.0 feet.

Monthly discharge of Androscoggin River at Dixfield, Me., for 1906.

[Drainage area, 2,230 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April	15,100	1,790	6,940	3.11	3.47
May	19,600	8,490	11,000	4.93	5.68
June	10,900	4,420	7,540	3.38	3.77
July	5,060	1,940	2,950	1.32	1.52
August	4,270	1,660	2,120	.951	1.10
September	2,480	1,600	1,810	.812	.91
October	4,740	1,660	2,380	1.07	1.23
November	2,800	1,660	1,950	.874	.98

NOTE.—Values are rated as follows: April to June, excellent; July to November, good.

PRESUMPSCOT RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Presumpscot River is one of the most interesting as well as one of the best water-power streams of its size in the United States. It is the outlet of Sebago Lake, which lies about 17 miles northwest of Portland. The lake is fed by Crooked River, a stream heading 35 miles farther north and within 3 miles of the Androscoggin. The area of the lake is 46 square miles; the total water surface on the drainage basin is 97 square miles; the area of the drainage basin at the outlet of the lake is 420 square miles, and at the mouth of the river 600 square miles.

According to the survey made by Joseph A. Warren, of Cumberland Mills, the fall from the crest of the stone dam at the foot of Sebago Lake to mean low tide at the foot of the lower falls is 265.16 feet in a distance of 21.65 miles, or an average of 12.25 feet per mile.

During the past few years several new developments have been made along the river, so that the only portion now unimproved is the fall of 56 feet between Great Falls and Gambo Falls.

The tributaries of Presumpscot River are not of much importance, but some of them are outlets of ponds and have considerable fall, thus affording constant though small power. Crooked River, the chief feeder of Sebago Lake, has a number of falls, some of which are utilized.

The chief interest attaching to the river is its regularity of flow which is due to dams at the outlet of the lake. Nowhere in the United States is there a better example of the success of storage of water and regulation of the flow of a stream than on the Presumpscot.

PRESUMPSCOT RIVER AT OUTLET OF SEBAGO LAKE, MAINE.

Since January, 1887, the flow from Sebago Lake has been regularly recorded, the quantity being deduced during most of this time from the openings in the gates at the dam, the discharging capacity of which under different conditions of head has been determined and tabulated by Hiram F. Mills, of Lowell. A continuous record of the Sebago Lake level has been kept since January, 1872, and the records of lake level and discharge make an unusually complete and valuable series of data. These have been furnished from time to time by S. D. Warren & Co. The conditions at this station are described in Water-Supply Paper No. 165, page 85, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Presumpscot River, at outlet of Sebago Lake, Maine, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	450	543	555	392	540	484	507	553	712	766	705	519
2	490	578	668	548	540	510	634	582	358	766	705	406
3	483	597	655	550	540	380	648	750	724	766	705	518
4	493	419	433	555	540	550	571	747	724	766	408	518
5	493	616	605	520	554	549	559	380	726	766	700	462
6	487	630	538	555	397	524	639	767	728	766	699	482
7	297	608	530	534	542	526	559	744	732	600	697	460
8	476	610	533	379	550	636	486	761	700	742	697	450
9	497	616	505	528	543	634	653	736	359	734	692	377
10	505	611	540	530	543	362	650	765	733	625	692	447
11	495	451	450	530	550	635	642	734	735	650	423	433
12	508	598	542	531	543	643	647	369	736	717	690	425
13	513	608	541	531	371	639	647	759	750	717	686	440
14	337	643	533	532	543	650	662	759	730	528	685	446
15	498	671	542	384	543	550	360	729	700	713	681	450
16	517	671	542	534	543	625	648	740	434	713	685	417
17	510	661	539	535	543	392	645	740	734	713	681	455
18	510	452	392	535	600	624	658	759	734	713	515	457
19	523	675	534	537	643	584	640	365	746	710	677	445
20	515	695	540	538	386	600	645	752	746	710	674	458
21	467	685	549	538	618	626	652	741	750	497	670	466
22	483	677	544	370	640	644	382	741	744	710	670	460
23	501	685	540	538	636	656	836	750	422	710	608	415
24	500	667	539	534	636	250	731	735	756	710	523	519
25	520	490	463	540	643	551	786	709	763	710	403	519
26	520	687	537	540	644	549	729	355	766	708	541	517
27	512	687	545	540	400	549	734	734	766	708	560	517
28	663	678	552	534	462	549	728	724	768	572	557	519
29	517	.....	550	396	392	550	423	697	768	707	557	517
30	517	.....	540	540	288	584	712	700	374	707	532	417
31	521	.....	542	.....	484	.....	530	722	.....	707	.....	517

Monthly discharge of Presumpscot River at outlet of Sebago Lake, Maine, for 1906.

[Drainage area, 420 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	663	297	494	1.18	1.36
February	695	419	616	1.47	1.53
March	668	392	537	1.28	1.48
April	555	370	512	1.22	1.36
May	644	288	529	1.26	1.45
June	656	250	554	1.32	1.47
July	836	360	624	1.49	1.72
August	767	355	681	1.62	1.87
September	768	358	681	1.62	1.81
October	766	497	698	1.66	1.91
November	705	403	624	1.49	1.66
December	519	377	466	1.11	1.28
The year	836	250	585	1.39	18.90

SACO RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Saco River receives its headwaters from the valleys and slopes of the White Mountains, at elevations of 4,000 to 5,000 feet. It drains an area of 1,720 square miles, of which 900 square miles lie in New Hampshire and the remainder in Maine. The slopes at the headwaters are very steep, with no lake storage. In the lower river are many good water powers, part of which are in use. The Great Falls, at Hiram, Me., are shown in Pl. V. (See also Pl. III, *B*.)

SACO RIVER NEAR CENTER CONWAY, N. H.

This station was established August 26, 1903. It is located at the wooden highway bridge between Center Conway and Redstone, N. H., about 2 miles from each place. The conditions and the bench marks are described in New Hampshire Forestry Reports for 1903–1906, and in Water-Supply Paper No. 165, page 87, where are given also references to publications that contain data for previous years. Elevation of bench mark, May 3, 1906, was 27.74 feet above datum of gage.

Discharge measurements of Saco River near Center Conway, N. H., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 3	T. W. Norcross	228	896	6.23	2.110
August 20 [a]	G. M. Brett	122	153	3.30	185
October 2 [b]	F. E. Pressey	125	134	3.27	144

[a] Right channel; measured by wading 300 feet below bridge.
[b] Right channel; measured by wading 230 feet below bridge.

Daily gage height, in feet, of Saco River near Center Conway, N. H., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		6.5		4.35	6.2	6.2	4.9	4.3	3.4	3.2	4.0	
2		5.7		4.2	6.3	6.45	4.8	4.05	3.55	3.2	3.9	
3				4.15	6.3	6.3	4.65	3.9	3.5	3.2	3.75	
4				4.3	6.45	5.25	4.65	3.8	3.5	3.25	3.8	
5				4.85	6.55	5.05	4.4	3.75	3.45	3.2	3.75	
6				5.25	6.55	5.8	4.35	3.7	3.4	3.2	3.7	
7	4.95			5.45	6.25	6.0	4.3	3.7	3.4	3.2	3.7	
8				4.7	6.7	6.2	4.3	3.7	3.35	3.5	3.7	
9				4.7	7.85	5.85	4.2	3.7	3.35	3.6	3.65	
10				4.65	6.35	5.3	4.2	3.7	3.3	3.55	3.7	
11		5.5		4.65	5.95	5.1	4.15	3.65	3.35	5.55	3.65	
12				4.8	6.1	4.95	4.1	3.6	3.45	4.9	3.75	
13				5.25	6.45	4.85	4.0	3.55	3.4	4.5	3.7	
14	5.3			5.4	6.4	4.65	3.95	3.5	3.45	4.45	3.75	
15				7.5	6.3	4.6	3.9	3.4	3.35	3.6	3.7	
16				9.25	6.55	4.5	3.9	3.4	3.3	3.55	3.65	
17				7.8	6.6	4.5	3.85	3.35	3.3	3.55	3.65	
18		5.1		7.65	6.65	6.65	3.9	3.4	3.2	3.5	3.7	
19				7.6	6.75	5.65	3.85	3.35	3.2	3.5	3.9	
20				7.75	6.65	5.05	3.75	3.3	3.15	3.5	4.3	

Daily gage height, in feet, of Saco River near Center Conway, N. H., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	5.1	.....	.....	7.8	5.05	4.9	3.9	3.3	3.1	4.45	4.25	.....
22	.....	.....	.....	6.2	4.9	4.6	5.1	3.35	3.05	4.1	4.2	.....
23	.....	.....	.....	6.0	4.85	5.0	4.3	3.4	3.2	3.6	4.1	.....
24	.....	.....	.....	6.0	4.8	6.65	4.25	3.45	3.2	3.55	4.1	.....
25	9.0	.....	.....	6.05	5.05	5.9	4.1	3.5	3.2	3.9	4.1	.....
26	6.65	.....	.....	6.25	5.4	5.35	3.85	3.4	3.15	5.7	4.1	.....
27	6.25	.....	.....	6.55	5.75	4.9	3.7	3.45	3.2	4.55	4.1	.....
28	6.2	.....	.....	6.55	7.45	4.75	3.75	4.5	3.2	4.25	4.15	.....
29	6.35	.....	4.85	6.55	8.7	5.05	3.65	4.05	3.2	4.2	4.2	.....
30	6.8	.....	4.65	6.5	7.0	5.3	4.6	3.7	.....	4.1	.....	.....
31	6.75	.....	4.5	.....	6.6	.....	4.95	3.45	.....	4.0	.....	.....

NOTE.—The following ice conditions prevailed during 1906: River frozen January 1 to 25, except for small open-water area in left span just above gage; ice went out January 25; river frozen over again February 4. Narrow stretches of open water remained in left channel near gage for the rest of the winter and the ice was thin and weak. Ice went out the morning of March 29. River frozen December 1 to 31. During the frozen period gage heights were taken to water surface through a hole in the ice. The following comparative readings were taken:

Comparative ice and water readings.

Date.	Water surface.	Top of ice.	Thickness of ice.	Date.	Water surface.	Top of ice.	Thickness of ice.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*	*Feet.*
January 7	4.95	5.15	1.1	February 25	.....	4.95	.....
January 14	5.3	5.45	1.5	March 4	.....	4.8	.....
January 21	5.1	5.2	1.0	March 11	.....	4.25	.....
February 4	.....	6.1	(a)	March 18	.....	4.75	.....
February 11	5.5	5.55	.65	March 25	.....	4.5	.....
February 18	5.1	5.15	.8				

a Ice thin.

Rating table for Saco River near Center Conway, N. H., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.00	100	4.20	504	5.40	1,272	7.20	3,030
3.10	115	4.30	557	5.50	1,349	7.40	3,285
3.20	133	4.40	612	5.60	1,428	7.60	3,555
3.30	154	4.50	669	5.70	1,509	7.80	3,835
3.40	178	4.60	728	5.80	1,592	8.00	4,120
3.50	206	4.70	789	5.90	1,677	8.20	4,425
3.60	238	4.80	852	6.00	1,764	8.40	4,740
3.70	274	4.90	917	6.20	1,950	8.60	5,060
3.80	314	5.00	984	6.40	2,150	8.80	5,395
3.90	358	5.10	1,053	6.60	2,355	9.00	5,735
4.00	404	5.20	1,124	6.80	2,570	10.00	7,600
4.10	453	5.30	1,197	7.00	2,795		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1906 and is well defined between gage heights 3.3 feet and 9.0 feet.

Monthly discharge of Saco River near Center Conway, N. H., for 1906.

[Drainage area, 385 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April	6,180	479	1,950	5.07	5.66
May	5,220	852	2,150	5.57	6.42
June	2,410	669	1,320	3.43	3.83
July	1,050	256	521	1.35	1.56
August	669	154	261	.678	.78
September	222	108	157	.408	.46
October	1,510	133	404	1.05	1.21
November	557	256	363	.943	1.05

NOTE.—Values are rated as follows: April to June, excellent; July, August, October, November, good; September, fair.

MERRIMAC RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The Merrimac basin, which has a total drainage area of 5,015 square miles, lies in the States of New Hampshire and Massachusetts, 3,815 square miles being in the former State and 1,200 square miles in the latter. Merrimac River is formed at Franklin, N. H., by the junction of Pemigewasset and Winnepesaukee rivers. The headwaters of the Pemigewasset lie in the White Mountain region at elevations of, approximately, 2,000 feet; thence they flow southward through New Hampshire with very steep slopes. On this branch of the Merrimac there is very little lake storage. Squam and New Found lakes, aggregating about 20 square miles of surface area, are the only bodies of water of any importance. Above Plymouth probably 85 per cent of the basin is in heavy forest. A very insignificant amount of water power is utilized. Winnepesaukee River has its headwaters in the eastern part of the State. A prominent characteristic of its basin is the extent of the lake surface, aggregating 100 square miles. The fall from Winnepesaukee Lake to the junction with Pemigewasset River is 225 feet in a distance of 14 miles.[a]

From Franklin, Merrimac River flows southward through the State of New Hampshire for 56 miles, receiving Contoocook River from the west and Suncook River from the east. After entering Massachusetts the river deflects to the east and flows in an easterly and northeasterly direction for a distance of 40 miles, to Newburyport, where it enters an arm of the sea. Tide flows to Lawrence.

The drainage areas of Merrimac River and some of its principal tributaries are given in Water-Supply Paper No. 165, page 91.

MERRIMAC RIVER AT FRANKLIN JUNCTION, N. H.

This station was established July 8, 1903. It is located at the wooden railway bridge near Franklin Junction, about a mile below the union of Pemigewasset and Winnepesaukee rivers. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 91, where are given also references to publications that contain data for previous years.

Discharge measurements of Merrimac River at Franklin Junction, N. H., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 16	T. W. Norcross	270	3,750	15.98	23,300
April 17	do	270	2,840	12.60	16,000
April 17	do	270	2,620	11.75	14,400
April 26	do	231	1,210	6.35	4,480
July 20	G. M. Brett	223	815	4.60	1,630
September 28	F. E. Pressey	216	695	4.06	1,080
October 10	do	216	772	4.58	1,330

[a] Tenth Census, vol. 16, p. 50.

Daily gage height, in feet, of Merrimac River at Franklin Junction, N. H., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.4	5.3	4.75	.....	.....	7.3	.....	5.5	.....	4.1	4.5	4.5
2	5.0	5.35	4.65	5.6	6.4	7.1	5.7	5.1	.....	4.0	4.5	.....
3	4.8	5.3	4.7	5.5	6.3	.....	5.6	4.8	.....	4.05	4.4	4.5
4	4.8	.....	.....	5.7	.....	6.6	.....	4.7	4.3	4.05	.....	4.3
5	5.3	4.9	4.6	6.6	6.45	6.1	5.75	.....	4.3	4.0	4.3	4.2
6	5.1	4.8	4.8	7.3	.....	6.0	5.6	4.6	4.3	4.0	4.3	4.25
7	.....	4.85	4.7	6.8	6.15	7.3	5.3	4.6	4.3	.....	4.3	4.35
8	4.8	4.8	4.7	.....	6.2	7.3	.....	4.6	4.4	4.1	4.2	4.3
9	5.0	4.8	4.6	6.05	6.0	.....	4.9	4.5	.....	4.1	4.25	.....
10	4.9	4.7	4.7	5.9	7.35	.....	4.9	4.4	4.3	4.5	4.3	5.05
11	4.8	.....	.....	5.9	7.3	6.4	4.9	4.4	4.2	4.9	.....	4.9
12	4.65	5.1	4.65	6.3	6.7	6.2	4.9	.....	4.1	4.5	4.45	4.85
13	4.8	4.8	4.5	6.6	.....	6.0	4.8	4.6	4.2	4.4	4.5	4.7
14	.....	4.6	4.5	7.0	7.6	5.8	4.55	4.45	4.1	.....	4.4	4.6
15	4.8	4.6	4.5	.....	6.8	5.5	.....	4.4	4.0	4.3	4.3	4.5
16	4.85	4.6	4.5	16.2	6.3	5.3	4.5	4.2	.....	4.2	4.2	.....
17	5.0	4.5	4.5	12.1	6.3	.....	4.5	4.3	4.2	4.2	4.2	4.5
18	5.0	.....	.....	10.1	6.85	6.2	4.8	4.2	4.15	4.25	.....	4.5
19	4.95	4.5	4.4	9.45	.....	6.2	4.75	.....	4.0	4.2	4.1	4.6
20	4.9	4.5	4.4	8.85	.....	6.0	4.6	4.1	4.05	.....	4.2	4.5
21	.....	4.45	4.45	.....	5.9	5.7	4.7	4.1	4.1	.....	4.6	4.6
22	5.3	.....	4.5	.....	5.6	5.6	.....	4.15	4.0	5.0	4.95	4.6
23	5.65	4.9	4.4	8.2	5.3	5.4	5.0	4.25	.....	4.7	4.8	.....
24	.....	4.95	4.4	7.5	5.3	.....	4.85	4.3	4.2	4.6	4.8	4.8
25	9.6	.....	.....	6.8	5.6	6.85	4.7	4.3	4.2	4.5	.....	4.5
26	7.15	5.05	4.3	6.45	6.3	6.4	4.6	.....	4.1	6.6	4.7	4.4
27	6.05	5.1	4.45	6.2	.....	6.15	4.6	4.2	4.0	.....	4.6	4.45
28	.....	5.0	5.35	6.05	14.7	5.9	.....	4.2	4.0	.....	4.65	4.45
29	5.6	.....	5.9	.....	14.2	5.8	4.15	4.9	4.0	4.65	4.6	4.35
30	5.2	.....	6.2	6.2	.....	5.8	4.5	4.6	.....	4.7	4.5	.....
31	5.1	.....	6.1	.....	8.15	.....	.....	4.5	.....	4.6	.....	.....

NOTE.—The river does not usually freeze at or near the gage, and the flow is probably not greatly affected by ice conditions.

Rating table for Merrimac River at Franklin Junction, N. H., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.00	950	5.20	2,530	6.30	4,360	7.80	7,200
4.10	1,060	5.30	2,680	6.40	4,540	8.00	7,600
4.20	1,170	5.40	2,840	6.50	4,720	8.20	8,000
4.30	1,290	5.50	3,000	6.60	4,900	8.40	8,400
4.40	1,410	5.60	3,160	6.70	5,080	8.60	8,800
4.50	1,540	5.70	3,320	6.80	5,270	8.80	9,200
4.60	1,670	5.80	3,490	6.90	5,460	9.00	9,600
4.70	1,800	5.90	3,660	7.00	5,650	9.20	10,020
4.80	1,940	6.00	3,830	7.20	6,030	9.40	10,440
4.90	2,080	6.10	4,000	7.40	6,410	9.60	10,860
5.00	2,230	6.20	4,180	7.60	6,800	9.80	11,280
5.10	2,380						

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is well defined. Above gage height 9 feet the rating curve is a tangent, the difference being 210 per tenth. The curve for high stages has been drawn about 5 to 10 per cent greater than the 3 high-water measurements of 1906, all of which were made on a rapidly falling stage. It is considered as closely representing the flow for stationary stages.

Monthly discharge of Merrimac River at Franklin Junction, N. H., for 1906.

[Drainage area, 1,460 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	10,900	1,730	2,950	2.02	2.33
February	2,760	1,170	1,980	1.36	1.42
March	4,180	1,120	1,830	1.25	1.44
April	24,700	3,000	6,610	4.53	5.05
May	21,600	2,680	5,930	4.06	4.68
June	6,220	2,680	4,210	2.88	3.21
July	3,490	1,120	2,140	1.47	1.70
August	3,000	1,060	1,500	1.03	1.19
September	1,410	950	1,130	.774	.86
October	4,900	950	1,620	1.11	1.28
November	2,160	1,060	1,470	1.01	1.13
December	2,300	1,170	1,630	1.12	1.29
The year	24,700	950	2,750	1.88	25.58

NOTE.—The discharge has been estimated for days on which the gage was not read.

Values are rated as follows: January to August, excellent; September, good; October to December, fair, owing to measurement of October 10, indicating a possible change in conditions of flow.

MERRIMAC RIVER AT GARVINS FALLS, N. H.

The power at Garvins Falls—4 miles below Concord—is one of the best on Merrimac River. There has been a dam at this point since 1815, first in connection with the Old Bow Canal and later to furnish power for a pulp mill. This privilege has since become the property of the Manchester Traction, Light and Power Company, and has been more completely developed.

Careful records of the pond and tail-race levels, wheel openings, etc., have been kept by the company since the completion of the new dam in 1904, and have been furnished for computations of flow by J. Brodie Smith, manager. The conditions at this station are described in Water-Supply Paper No. 165, page 94.

Discharge measurements of Merrimac River at Garvins Falls, N. H., in 1904–1906.

Date.	Hydrographer.	Width.	Area of section.	Reference point to water surface.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1904.					
November 3	T. W. Norcross	358	1,410	25.69	2,520
November 10	do	320	1,200	26.19	2,070
November 23	do	345	1,270	25.88	2,330
1906.					
April 18	T. W. Norcross	463	5,070	17.14	23,500
April 18	do	463	4,960	17.50	23,000
April 18	C. R. Adams	463	5,110	17.14	24,900
October 10	Barrows and Pressey	296	1,120	26.25	2,010
October 11	F. E. Pressey	351	1,260	26.02	2,470
October 11	do	367	1,300	25.80	2,450

NOTE.—All of these measurements were made from the downstream side of the Hammond Street bridge, Concord, N. H., for the purpose of obtaining the coefficients of the dam.

Daily discharge, in second-feet, of Merrimac River at Garvins Falls, N. H., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4,480	4,260	3,370	8,300	6,150	13,000	5,480	5,020	2,040	1,220	2,040	2,240
2	4,040	4,230	3,380	7,080	6,310	9,740	6,270	3,720	1,500	1,280	1,970	2,140
3	3,380	4,370	3,360	6,280	6,540	8,530	5,820	3,140	1,380	1,210	1,870	1,580
4	2,940	3,230	3,400	6,260	7,920	8,120	5,440	2,730	1,460	1,290	1,900	1,990
5	3,470	2,890	3,350	6,770	7,240	6,560	5,920	2,540	1,680	1,340	1,550	1,640
6	3,860	2,860	3,720	9,820	6,900	5,800	6,200	2,210	1,740	1,260	1,470	1,980
7	3,780	2,540	3,630	10,810	6,510	6,850	4,910	2,400	1,510	1,270	1,620	1,970
8	3,070	2,430	3,330	9,080	6,110	9,030	4,240	2,370	1,530	1,120	1,580	1,620
9	2,880	2,250	3,080	7,840	5,550	8,920	3,650	3,800	1,370	1,430	1,780	2,090
10	2,890	2,240	3,100	7,540	6,150	8,380	3,520	2,210	1,290	1,820	1,540	1,680
11	2,870	2,400	3,440	6,840	9,050	7,220	3,480	2,120	1,370	2,410	1,580	1,880
12	3,010	2,220	2,960	8,250	7,300	6,500	3,320	1,910	1,350	2,440	1,750	1,780
13	3,130	2,420	2,750	9,490	5,860	5,490	3,040	1,760	1,350	1,910	1,980	1,910
14	3,140	2,570	2,520	10,600	7,930	4,830	2,880	1,970	1,300	1,930	2,100	1,990
15	2,870	2,550	1,860	12,680	7,110	4,360	2,560	2,060	1,310	1,710	2,180	1,980
16	3,260	2,610	2,600	27,820	5,690	3,860	2,400	1,860	1,260	1,610	1,800	2,320
17	3,630	2,830	2,750	29,560	5,410	3,980	2,420	1,900	1,310	1,420	1,900	1,880
18	3,780	2,990	2,400	22,080	5,990	7,640	2,760	1,910	1,260	1,450	1,900	1,900
19	3,520	2,690	2,130	17,630	7,080	8,630	2,950	1,810	1,320	1,480	1,820	1,830
20	3,290	2,650	1,840	15,160	5,820	7,720	2,720	1,460	1,420	1,540	2,770	1,860
21	3,140	2,700	2,520	14,060	5,150	6,500	2,540	1,800	1,450	2,140	4,060	1,920
22	3,090	3,020	2,470	14,410	4,280	5,440	2,640	1,720	1,320	2,610	3,720	1,960
23	5,540	3,600	2,180	13,570	3,730	4,750	2,780	1,720	1,240	2,300	3,530	2,270
24	15,660	4,160	2,190	10,940	3,400	6,140	3,230	1,850	1,360	2,020	3,350	1,890
25	17,100	3,970	2,320	8,860	3,660	9,570	3,100	1,770	1,210	1,990	3,050	2,060
26	10,800	3,990	2,230	7,640	4,990	8,360	2,750	1,720	1,340	3,440	2,540	1,550
27	8,380	4,710	2,230	6,800	5,750	7,010	2,560	1,660	1,310	3,940	2,280	2,030
28	6,800	3,750	3,290	6,240	17,950	5,850	2,570	1,780	1,340	2,910	2,540	1,930
29	6,040	.....	8,010	5,980	28,010	5,020	2,290	2,420	1,350	2,220	2,760	2,110
30	5,180	.....	8,880	5,720	25,260	4,630	1,770	2,370	1,340	2,140	2,520	2,460
31	4,410	.....	9,090	.....	18,360	.....	3,270	2,160	.....	2,040	.....	1,710

Monthly discharge of Merrimac River at Garvins Falls, N. H., for 1906.

[Drainage area, 2,340 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	17,100	2,870	4,950	2.12	2.44
February	4,710	2,220	3,110	1.33	1.38
March	9,090	1,840	3,370	1.44	1.66
April	29,600	5,720	11,100	4.74	5.29
May	28,000	3,400	8,170	3.49	4.02
June	13,000	3,860	6,950	2.97	3.31
July	6,270	1,770	3,530	1.51	1.74
August	5,020	1,460	2,260	.966	1.11
September	2,040	1,240	1,400	.598	.67
October	3,940	1,120	1,900	.812	.94
November	4,060	1,470	2,250	.962	1.07
December	2,460	1,550	1,940	.829	.96
The year	29,600	1,120	4,250	1.81	24.59

NOTE.—Values are rated as good.

MERRIMAC RIVER AT LAWRENCE, MASS.

Records of flow of the Merrimac at Lawrence have been kept for more than fifty years, but have never been published in full. Data in regard to the flow are furnished by R. A. Hale, principal assistant engineer of the Essex Water Power Company. The conditions at the station are described in Water-Supply Paper No. 165, page 95, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Merrimac River at dam at Lawrence, Mass., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7,791	6,484	7,473	15,770	7,945	20,079	6,426	5,374	2,202	2,288	3,344	2,397
2	6,896	6,201	6,268	15,330	8,162	15,347	9,087	7,314	1,251	2,379	3,167	1,776
3	8,152	4,087	5,698	13,070	8,359	12,957	8,739	5,357	1,635	2,237	2,126	4,441
4	5,827	3,692	8,095	11,970	8,641	12,471	7,183	4,339	3,764	2,206	452	3,395
5	6,091	5,227	12,552	11,950	9,198	10,974	8,890	4,044	2,816	2,266	3,438	2,644
6	6,175	3,693	14,218	13,940	7,998	9,410	8,980	5,335	2,716	1,514	3,352	2,622
7	5,923	4,062	11,207	17,000	9,276	9,015	7,386	4,468	2,451	132	3,246	2,605
8	6,595	3,753	9,714	14,290	8,735	11,016	5,663	3,945	1,535	1,977	2,686	1,654
9	5,551	3,734	8,499	13,940	8,277	11,419	5,945	3,969	101	1,936	2,460	386
10	5,042	2,301	7,765	13,840	7,965	10,575	5,125	3,643	2,205	2,155	1,652	2,900
11	4,560	2,158	7,313	14,800	9,914	10,623	4,729	2,251	2,256	2,652	334	3,054
12	4,383	4,978	8,534	17,900	9,501	9,212	4,614	1,986	2,246	2,723	2,851	2,816
13	3,013	3,803	7,052	19,400	7,803	8,018	4,596	4,435	2,282	1,574	2,842	2,901
14	3,800	3,681	6,352	19,200	8,312	6,897	3,361	3,327	2,127	662	3,270	2,777
15	5,578	3,761	5,020	17,600	8,974	6,352	2,825	2,877	1,433	3,508	3,285	1,903
16	5,025	3,503	4,542	25,800	7,852	4,720	4,548	2,946	76	3,127	3,638	487
17	6,174	2,345	3,436	35,400	6,797	5,283	3,229	2,850	2,145	3,011	2,406	3,564
18	7,145	2,497	4,322	29,298	6,863	12,608	3,102	1,995	2,184	2,540	941	3,066
19	6,781	4,921	5,416	22,112	7,087	15,349	3,649	839	2,134	2,471	4,121	3,120
20	5,587	3,663	4,424	19,839	6,783	13,500	4,137	3,641	2,174	1,497	3,405	2,910
21	4,958	3,680	4,301	17,289	7,014	10,995	3,522	2,945	2,107	133	4,995	3,002
22	6,467	5,161	4,482	15,786	5,637	9,087	3,138	2,734	1,367	2,525	5,048	2,031
23	7,437	8,029	4,851	16,601	4,715	7,374	4,701	2,571	103	2,850	5,269	478
24	13,845	9,200	3,030	14,856	4,818	7,361	3,796	2,709	2,143	3,337	4,072	4,223
25	23,900	7,210	3,219	12,634	4,588	10,934	4,456	1,581	2,189	3,186	3,518	850
26	19,804	9,980	5,317	10,785	4,451	11,674	4,285	753	2,309	3,201	5,094	3,999
27	13,643	11,131	4,410	9,749	6,184	9,747	3,932	3,456	2,518	2,671	4,011	3,271
28	10,626	10,085	7,508	8,474	12,300	8,050	2,620	2,804	2,386	3,449	3,629	3,289
29	9,629	.....	17,100	7,621	35,650	6,779	2,599	2,596	1,515	4,738	1,659	2,239
30	6,770	.....	18,600	8,537	36,910	5,595	4,602	2,619	167	3,648	4,823	551
31	6,403	.....	17,500	.....	27,639	.....	3,604	3,040	.....	3,398	.....	4,054
Total	237,571	143,020	238,218	484,781	314,348	303,421	153,469	102,743	56,537	75,991	95,024	79,285
Average	7,664	5,108	7,684	16,159	10,140	10,114	4,951	3,314	1,885	2,451	3,167	2,558

Average weekly flow, arranged in order of discharge, of Merrimac River at Lawrence, Mass., for 1906.

Week ending Sunday—	Merrimac River at Lawrence (total drainage area=4,664 sq. m.).	Wasting into Merrimac from— Nashua River at Clinton (drainage area=118 sq. m.).	Sudbury River at Dam 1 (drainage area=75 sq. m.).	Lake Cochituate Bannister Brook (drainage area=19 sq. m.).	Total waste of these watersheds (total drainage area=212 sq. m.).	Net yield of Merrimac River from 4,452 square miles, in second-feet.	
	Second-feet for seven days.					Seven days.	Per sq. m.
September 23	1,745	6	2	0	8	1,737	0.390
September 16	1,804	6	2	0	8	1,796	.403
October 7	1,859	6	2	0	8	1,851	.416
September 30	1,890	6	2	0	8	1,882	.423
October 14	1,954	8	2	0	10	1,944	.437
September 9	2,145	6	2	0	8	2,137	.480
October 21	2,327	6	2	0	8	2,319	.521
December 16	2,405	5	2	0	7	2,398	.539
August 26	2,419	7	3	0	10	2,409	.541
November 11	2,453	5	2	0	7	2,446	.549
December 9	2,518	5	2	0	7	2,511	.564
September 2	2,567	6	3	0	9	2,558	.575
December 23	2,596	5	72	0	77	2,519	.566
December 30	2,632	4	42	0	46	2,586	.581
November 18	2,748	5	31	0	36	2,712	.609
August 19	2,753	7	8	0	15	2,738	.615
November 4	2,980	5	2	0	7	2,973	.668
October 28	3,031	5	2	0	7	3,024	.679
December 2	3,327	5	5	0	10	3,317	.745
February 18	3,510	4	28	0	32	3,478	.781
February 11	3,561	3	39	0	42	3,519	.790
July 22	3,618	7	11	0	18	3,600	.809
August 12	3,657	7	30	0	37	3,620	.813
July 29	3,770	6	2	0	8	3,762	.845
March 25	4,246	4	92	32	128	4,118	.925
November 25	4,347	5	30	0	35	4,312	.968
July 15	4,456	5	24	0	29	4,427	.994
January 14	4,706	4	51	0	55	4,651	1.045
August 5	4,948	7	2	0	9	4,939	1.110
May 27	5,344	6	6	0	12	5,332	1.198
March 18	5,608	5	128	36	169	5,439	1.222
January 21	5,893	4	72	0	76	5,817	1.307
February 25	5,981	6	104	0	110	5,871	1.319
February 4	6,181	4	55	0	59	6,122	1.375
January 7	6,408	5	77	0	82	6,326	1.421
June 17	7,301	7	20	0	27	7,274	1.634
May 20	7,524	8	10	0	18	7,506	1.686
July 8	7,990	6	55	0	61	7,929	1.781
March 4	8,390	6	142	0	148	8,242	1.851
May 6	8,406	6	8	0	14	8,392	1.885
July 1	8,458	7	16	0	23	8,435	1.895
May 13	8,782	5	9	0	14	8,768	1.969
March 17	10,181	5	209	34	248	9,933	2.231
June 10	10,697	6	45	0	51	10,646	2.391
June 24	10,896	5	28	0	33	10,863	2.440
April 29	11,531	6	72	8	86	11,445	2.571
April 1	12,315	7	248	96	351	11,964	2.687
January 28	13,675	5	79	0	84	13,591	3.053
April 8	13,936	7	136	27	170	13,766	3.092
April 15	16,669	9	214	58	281	16,388	3.681
June 3	22,983	6	175	0	181	22,802	5.122
April 22	23,646	6	127	34	167	23,479	5.274
Total (52 weeks)	325,767	297	2,532	325	3,154	322,613	72.466
Weekly average	6,255	6	49	6	61	6,204	1.393

PEMIGEWASSET RIVER AT PLYMOUTH, N. H.

This station was established September 5, 1903. It is located at the wooden highway bridge below the mouth of Bakers River in the town of Plymouth. The height of water at Plymouth has been recorded daily since January 1, 1886, during which time extensive deforestation in the basin above has taken place. This record of gage height has been given to the United States Geological Survey by the Locks and Canals Company, of Lowell, Mass. The conditions at the station and the bench marks are described in the New Hampshire Forestry Reports for 1903–1906, and in Water-Supply Paper No. 165, page 98, where are given also references to publications that contain data for previous years.

Discharge measurements of Pemigewasset River at Plymouth, N. H., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
July 4	Murphy and Barrows	202	777	3.94	2,060
August 3 [a]	H. K. Barrows	178	387	2.75	826
August 23 [b]	T. W. Norcross	124	257	1.80	370
September 5	do	224	1,400	6.88	5,840
October 7 [a]	do	142	282	2.01	466
October 28 [a]	do	113	208	1.51	240
October 28 [a]	do	113	208	1.57	272
1906.					
April 17	C. R. Adams	228	1,770	8.36	8,550
April 17	do	228	1,590	7.56	7,350
April 28	T. W. Norcross	212	813	4.00	2,140
July 21	G. M. Brett	168	312	1.69	328
August 24 [a]	do	106	181	1.42	199
September 29 [a]	F. E. Pressey	102	174	1.42	212
October 9 [a]	do	108	194	1.60	262

[a] In left channel by wading.
[b] In left channel by wading; meter fastened to a rod.

Daily gage height, in feet, of Pemigewasset River at Plymouth, N. H., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.4	3.0	3.4	3.1	4.8	4.4	3.35	2.8	1.6	1.3	2.2	2.35
2	3.2	2.9	3.55	2.9	4.8	4.05	2.9	2.4	1.55	1.35	2.1	2.25
3	2.85	2.8	2.8	3.0	4.9	4.1	2.6	2.2	1.5	1.4	1.9	1.7
4	2.9	3.15	2.75	3.3	5.2	3.7	2.65	2.1	1.6	1.35	1.9	2.1
5	3.5	3.45	2.8	3.55	4.9	3.4	3.3	1.95	1.7	1.2	1.9	2.05
6	3.5	3.55	2.9	4.7	4.7	3.85	2.8	1.85	1.55	1.2	1.85	2.05
7	3.2	3.4	2.7	3.7	4.45	5.8	2.45	1.8	1.5	1.1	1.8	2.2
8	2.9	3.5	2.5	3.35	4.1	4.7	2.3	1.7	1.5	1.2	1.8	[a] 2.1
9	2.8	3.5	2.35	3.3	4.4	4.75	2.2	1.75	1.45	1.3	1.8	2.25
10	3.0	3.7	2.25	3.1	6.6	4.0	2.3	1.7	1.5	2.6	1.8	2.4
11	3.0	3.6	2.2	3.1	5.0	3.85	2.2	1.7	1.4	2.6	1.9	2.5
12	3.1	3.4	2.1	3.25	4.6	3.4	2.1	1.7	1.4	2.15	1.9	2.4
13	2.85	3.4	2.2	3.35	6.2	3.15	2.0	1.65	1.5	1.95	2.0	2.5
14	3.05	3.35	2.15	4.15	5.5	3.0	1.9	1.7	1.5	1.75	1.9	2.5
15	2.8	3.3	2.4	9.0	4.5	2.75	1.85	1.6	1.45	1.65	1.85	2.6
16	2.85	3.2	2.15	12.35	4.3	2.6	1.8	1.55	1.5	1.65	1.8	[b] 2.4
17	3.05	3.15	2.0	8.35	4.5	2.65	1.9	1.5	1.4	1.5	1.8	2.5
18	2.9	3.15	1.9	7.8	5.85	3.7	2.1	1.5	1.4	1.6	1.75	2.8
19	2.8	3.1	2.3	6.9	5.05	3.2	1.9	1.45	1.4	1.6	2.1	2.65
20	2.7	3.1	2.2	6.6	4.2	2.8	1.8	1.4	1.3	1.8	3.25	2.6

[a] About one-half of section frozen over; open under gage and around pier.
[b] Almost frozen over at gage.

Daily gage height, in feet, of Pemigewasset River at Plymouth, N. H., for 1906—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	2.75	3.0	2.0	7.1	3.7	2.55	1.8	1.45	1.3	3.2	2.8	2.35
22	3.25	3.1	1.9	7.2	3.5	2.4	2.8	1.5	1.25	2.5	2.7	2.7
23	6.05	3.6	1.85	6.2	3.2	2.7	2.2	1.4	1.3	2.2	2.55	[a] 2.7
24	10.75	3.3	1.7	4.95	3.3	5.1	1.9	1.5	1.4	1.95	2.4	.....
25	6.25	3.1	1.85	4.25	3.9	3.8	1.9	1.6	1.3	2.3	2.3	.....
26	4.75	2.9	1.9	4.0	4.2	3.5	1.8	1.5	1.3	4.25	2.2	.....
27	4.25	3.35	1.95	4.0	5.6	2.85	1.7	1.55	1.3	3.0	2.45	.....
28	3.75	3.2	2.6	4.05	11.45	2.6	1.7	3.65	1.3	2.7	2.9	[b] 1.4
29	3.35	.....	3.8	3.9	9.75	2.55	1.7	2.3	1.4	2.5	2.6	.....
30	2.9	.....	4.1	4.35	6.6	2.8	2.7	1.8	1.3	2.3	2.0	.....
31	3.1	.....	3.8	.....	5.2	.....	4.2	1.7	.....	2.25	.....	.....

[a] Gage height to top of ice, open channel 10 feet wide near pier.
[b] River entirely frozen over; gage height to top of ice 1.5 feet.

NOTE.—The following ice conditions prevailed during 1906: River frozen over part of time in left channel only, January 1 to 23; ice went out January 23. During February left channel near gage was frozen over, right channel near gage was open for a width of about 70 feet; open-water strip extended upstream nearly to Bakers River, and some 500 feet downstream from gage. During March the open-water strip in right channel narrowed down to 60 feet width and extended but a short distance above and below the gage. Ice began to wear away again about March 24, and went out completely during the morning of April 6. River commenced to freeze from the sides about December 1, the ice gradually creeping toward the middle until December 28, when the river was entirley frozen. Until December 23 it was open under the gage.

During the frozen season gage readings are to water surface, the gage being over the right channel, which remained open. The average thickness of ice for the left channel and for the frozen portion near the gage upstream and downstream was as follows:

Thickness of ice.

Date.	Thickness of ice.	Date.	Thickness of ice.
	Feet.		*Feet.*
February 7	0.3	March 17	1.1
February 17	.7	December 8	.3
February 24	.7	December 23	.9
March 3	.9	December 28	.8
March 10	.9		

Rating table for Pemigewasset River at Plymouth, N. H., for 1905-6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	140	2.40	720	3.70	1,830	6.00	4,590
1.20	158	2.50	790	3.80	1,930	6.20	4,890
1.30	183	2.60	865	3.90	2,030	6.40	5,200
1.40	211	2.70	945	4.00	2,130	6.60	5,520
1.50	243	2.80	1,025	4.20	2,340	6.80	5,850
1.60	278	2.90	1,105	4.40	2,555	7.00	6,185
1.70	317	3.00	1,190	4.60	2,780	8.00	7,970
1.80	361	3.10	1,275	4.80	3,010	9.00	9,970
1.90	410	3.20	1,365	5.00	3,250	10.00	12,050
2.00	465	3.30	1,455	5.20	3,500	11.00	14,150
2.10	525	3.40	1,545	5.40	3,760	12.00	16,250
2.20	585	3.50	1,640	5.60	4,030	13.00	18,350
2.30	650	3.60	1,735	5.80	4,305		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is well defined.

Monthly discharge of Pemigewasset River at Plymouth, N. H., for 1905–6.

[Drainage area, 615 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
April	7,140	1,500	3,180	5.18	5.78
May	3,440	865	1,690	2.74	3.16
June	5,040	650	1,280	2.07	2.31
July	4,590	317	920	1.50	1.73
August	2,500	317	702	1.14	1.31
September	9,570	790	2,460	4.00	4.46
October	2,030	386	732	1.19	1.37
November	3,250	361	687	1.12	1.25
December	5,040	361	1,470	2.39	2.76
1906.					
April (6–30)	17,000	1,280	4,180	6.80	6.32
May	15,100	1,360	3,700	6.01	6.93
June	4,300	720	1,700	2.76	3.08
July	2,340	317	688	1.12	1.29
August	1,780	211	394	.641	.74
September	317	170	222	.361	.40
October	2,390	140	542	.881	1.02
November	1,410	339	573	.932	1.04

NOTE.—Values for 1905 and 1906 are excellent.

CONTOOCOOK RIVER AT WEST HOPKINTON, N. H.

This station was established July 9, 1903. It is located at the wooden highway bridge near the railway station at West Hopkinton. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 101, where are given also references to publications that contain data for previous years. Length of chain, April 27, 1906, 26.02 feet.

Discharge measurements of Contoocook River at West Hopkinton, N. H., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 27	T. W. Norcross	124	320	3.97	920
July 19	G. M. Brett	120	230	3.22	508

Daily gage height, in feet, of Contoocook River at West Hopkinton, N. H., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.55	3.5	3.5	5.05	3.6	5.55	3.7	3.25	2.5	2.3	2.75	2.95
2	3.55	3.6	3.5	4.6	3.6	4.8	4.1	3.15	2.4	2.3	2.65	2.8
3	3.4	3.5	3.5	4.3	3.85	4.5	4.0	2.85	2.4	2.35	2.6	2.95
4	3.6	3.5	3.4	4.2	4.0	4.3	3.9	2.85	2.3	2.3	2.55	[a] 3.9
5	3.8	3.3	3.65	4.65	3.9	3.9	4.4	2.8	2.3	2.2	2.6	3.7
6	3.75	3.5	3.6	5.2	3.7	3.7	4.1	2.85	2.3	2.2	2.5	3.55
7	3.7	3.4	3.6	5.2	3.7	3.6	3.7	2.85	2.3	2.3	.....	3.75
8	3.8	3.5	3.55	5.0	3.8	3.65	3.4	2.9	2.3	2.3	.....	[a] 3.85
9	3.7	3.6	3.55	4.75	3.8	3.8	3.3	2.8	2.3	2.3	2.55	[a] 4.05
10	3.7	3.3	3.5	4.5	3.95	3.9	3.2	2.75	2.2	2.65	2.5	[a] 4.2
11	3.75	3.3	3.45	4.4	4.0	3.95	3.2	2.7	2.2	2.95	2.5	[a] 4.15
12	3.9	3.65	3.4	5.0	3.8	3.8	3.2	2.65	2.3	2.85	2.6	[a] 4.3
13	4.05	3.9	3.35	5.3	3.7	3.6	3.15	2.6	2.2	2.8	2.85	4.35
14	4.0	3.75	3.2	5.75	3.6	3.4	3.0	2.5	2.3	2.7	2.85	3.95
15	3.65	3.6	3.3	6.9	3.5	3.2	2.9	2.45	2.3	2.5	2.8	3.85

[a] Anchor ice in river.

Daily gage height, in feet, of Contoocook River at West Hopkinton, N. H., for 1906 Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	3.6	3.65	3.1	8.4	3.4	3.1	2.8	2.5	2.2	2.4	2.7	3.95
17	3.8	3.75	3.05	8.0	3.45	3.55	2.85	2.4	2.3	2.3	2.75	3.85
18	3.75	3.8	3.0	6.55	3.6	4.8	2.95	2.5	2.25	2.35	2.7	3.75
19	3.7	3.9	2.9	5.8	3.5	5.0	3.15	2.4	2.2	2.4	3.2	3.7
20	3.6	3.8	3.0	5.35	3.4	4.65	3.1	2.5	2.3	2.55	4.1	3.6
21	3.5	3.9	3.1	5.05	3.3	4.1	3.05	2.4	2.3	2.85	4.0	3.55
22	3.8	4.1	3.0	4.85	3.2	3.75	3.0	2.4	2.3	2.8	3.9	3.5
23	6.0	4.0	3.05	4.65	3.1	3.5	2.95	2.4	2.3	2.95	3.85	3.5
24	7.3	3.8	3.0	4.6	3.1	4.0	3.0	2.7	2.3	2.8	3.5	3.45
25	6.3	3.9	3.05	4.3	3.4	4.7	3.1	2.65	2.3	2.9	3.3	3.5
26	4.9	3.75	2.9	4.15	3.6	4.1	2.9	2.6	2.35	2.85	3.0	3.6
27	4.6	3.7	3.45	3.95	3.75	3.6	2.85	2.6	2.3	3.05	2.95	3.45
28	4.1	3.5	5.3	3.8	6.3	3.4	2.8	.....	2.3	2.9	3.05	3.4
29	3.8	.....	5.4	3.8	7.65	3.3	2.75	.....	2.35	2.8	3.0	3.4
30	3.6	.....	5.5	3.6	7.65	3.25	2.8	.....	2.3	2.8	3.0	3.5
31	3.6	.....	5.2	.....	7.0	.....	2.95	2.5	.....	2.85	.....	3.55

NOTE.—During the winter months considerable trouble is experienced from anchor ice forming around rocks and forming backwater.

Rating table for Contoocook River at West Hopkinton, N. H., for 1905 6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.20	143	3.40	651	4.60	1,805	6.60	4,694
2.30	165	3.50	724	4.70	1,925	6.80	5,022
2.40	185	3.60	801	4.80	2,045	7.00	5,350
2.50	209	3.70	882	4.90	2,165	7.20	5,678
2.60	237	3.80	967	5.00	2,290	7.40	6,006
2.70	270	3.90	1,056	5.20	2,550	7.60	6,334
2.80	308	4.00	1,150	5.40	2,820	7.80	6,662
2.90	352	4.10	1,250	5.60	3,100	8.00	6,990
3.00	402	4.20	1,355	5.80	3,395	9.00	8,630
3.10	457	4.30	1,465	6.00	3,710		
3.20	517	4.40	1,575	6.20	4,038		
3.30	582	4.50	1,690	6.40	4,366		

NOTE.—The above table is applicable only for open-channel conditions. It is based on twelve discharge measurements made during 1905–6 and is well defined between gage heights 2.4 feet and 9.0 feet.

Monthly discharge of Contoocook River at West Hopkinton, N. H., for 1906.

[Drainage area, 410 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April	7,650	801	2,500	6.10	6.81
May	6,420	457	1,430	3.49	4.02
June	3,030	457	1,170	2.85	3.18
July	1,580	289	583	1.42	1.64
August	550	185	265	.646	.74
September	209	143	164	.400	.45
October	430	143	254	.620	.72
November	1,250	209	429	1.05	1.17

NOTE.—Values are rated as follows: September, good; remainder of the period, excellent.

SUDBURY RIVER AT FRAMINGHAM AND LAKE COCHITUATE AT COCHITUATE, MASS.

Sudbury River and Lake Cochituate have been studied by the engineers of the city of Boston, the State board of health of Massachusetts, and the metropolitan water and sewerage board; records of rainfall in the Sudbury basin have been kept since 1875 and in the Cochituate basin since 1852, but the latter are considered of doubtful accuracy previous to 1872.

The conditions at this station and the bench marks are described in Water-Supply Paper No. 165, page 104, where are given also references to publications that contain data for previous years.

The accompanying tables, furnished by Frederic P. Stearns, give the results for 1906, also the averages for thirty-two years for Sudbury River and for forty-four years for Lake Cochituate.

Yield and rainfall in Sudbury River watershed at Framingham, Mass.

[Drainage area, 75.2 square miles.]

Month.	Total yield in million gallons.	Average yield of 1 square mile.		Rainfall in inches.[a]	Rainfall collected in inches.[a]	Per cent collected.
		Million gallons per day.	Second-feet.			
1906.						
January	2,629.5	1.128	1.745	2.47	2.012	81.5
February	2,190.9	1.041	1.610	2.92	1.676	57.5
March	5,615.7	2.409	3.727	6.32	4.297	68.1
April	4,396.1	1.949	3.015	2.88	3.364	116.6
May	2,469.5	1.059	1.639	5.66	1.890	33.4
June	1,594.0	.707	1.093	3.91	1.220	31.2
July	927.0	.398	.615	3.42	.709	20.7
August	420.0	.180	.279	3.02	.321	10.6
September	43.9	.019	.030	3.30	.034	1.0
October	702.8	.301	.466	3.40	.538	15.8
November	1,089.6	.483	.747	2.69	.834	31.1
December	1,535.4	.659	1.019	4.49	1.175	26.2
The year	23,614.4	.860	1.331	44.48	18.070	40.6
1875–1906.						
January	91,014.7	1.220	1.888	4.19	2.176	52.0
February	121,403.4	1.788	2.766	4.22	2.903	68.7
March	220,293.6	2.953	4.569	4.60	5.268	114.5
April	151,296.9	2.096	3.242	3.56	3.618	101.7
May	82,987.5	1.113	1.721	3.35	1.984	59.2
June	37,975.4	.526	.814	3.17	.908	28.6
July	14,853.9	.199	.308	3.72	.355	9.6
August	21,025.6	.282	.436	3.98	.503	12.6
September	18,971.7	.263	.407	3.43	.454	13.2
October	36,465.7	.489	.756	4.12	.872	21.2
November	60,496.0	.838	1.296	3.86	1.446	37.5
December	79,300.3	1.063	1.645	3.84	1.896	49.3
The period	936,084.7	1.065	1.648	46.04	22.384	48.6

[a] Total for month for 1906; average of totals per calendar month 1875 to 1906.

Yield and rainfall in Cochituate Lake watershed at Cochituate, Mass.

[Drainage area, 18.87 square miles.]

Month.	Total yield in million gallons.	Average yield of 1 square mile. Million gallons per day.	Average yield of 1 square mile. Second-feet.	Rainfall in inches.[a]	Rainfall collected in inches.[a]	Per cent collected.
1906.						
January	515.2	0.881	1.363	2.66	1.57	59.0
February	418.5	.792	1.226	2.59	1.28	49.3
March	1,140.7	1.950	3.017	6.47	3.48	53.8
April	873.9	1.544	2.388	2.60	2.66	102.5
May	527.5	.902	1.395	4.98	1.61	32.3
June	282.3	.499	.772	3.44	.86	25.0
July	241.9	.414	.640	3.04	.74	24.3
August	185.3	.317	.490	2.37	.57	23.8
September	156.8	.277	.429	2.84	.48	16.8
October	279.2	.477	.738	3.26	.85	26.1
November	264.0	.466	.722	2.50	.80	32.2
December	266.5	.456	.705	4.68	.81	17.4
The year	5,151.8	.748	1.157	41.43	15.71	37.9
1863–1906.						
January	28,826.8	1.120	1.733	3.95	2.00	50.6
February	36,490.5	1.532	2.371	3.95	2.53	64.8
March	57,206.9	2.222	3.438	4.47	3.97	88.7
April	42,941.9	1.724	2.667	3.65	2.97	81.5
May	25,244.0	.980	1.516	3.71	1.75	47.2
June	11,642.5	.467	.723	3.08	.81	26.2
July	7,639.5	.297	.459	4.09	.53	13.0
August	10,871.0	.422	.653	4.32	.75	17.4
September	10,791.4	.433	.670	3.57	.75	20.9
October	14,836.4	.576	.892	4.31	1.03	23.9
November	20,070.4	.808	1.247	4.09	1.39	34.0
December	24,446.7	.950	1.469	3.58	1.69	47.3
The period	290,988.0	.959	1.485	46.77	20.17	43.1

[a] Total per month for 1905; average of totals per calendar month 1863–1906.

SOUTH BRANCH OF NASHUA RIVER AT CLINTON, MASS.

Since July, 1896, the flow of South Branch of Nashua River has been measured at Clinton by the engineers of the metropolitan water and sewerage board. The results of these measurements have been furnished by Frederic P. Stearns, chief engineer. Beginning with 1897 the flow has been corrected for loss and gain of storage in ponds and mill reservoirs on the watershed, so that the results show the natural flow of the stream. The accompanying tables give the results for 1906, also the average for the years 1897–1906, inclusive. The conditions at the station and the bench marks are described in Water-Supply Paper No. 165, page 108, where are given also references to publications that contain data for previous years.

Yield and rainfall in South of Branch Nashua River watershed at Clinton, Mass.

[Drainage area, 119 square miles.]

Month.	Total yield in million gallons.	Average yield of 1 square mile.		Rainfall in inches.[a]	Rainfall collected in inches.[a]	Per cent collected.
		Million gallons per day.	Second-feet.			
1906.						
January	4,174.7	1.132	1.751	2.59	2.018	78.1
February	3,420.3	1.027	1.588	2.74	1.654	60.5
March	6,861.7	1.860	2.878	5.17	3.317	64.2
April	7,528.2	2.109	3.263	3.12	3.640	116.5
May	5,654.2	1.533	2.371	6.58	2.734	41.5
June	4,225.4	1.184	1.831	5.95	2.043	34.3
July	2,686.3	.728	1.127	5.52	1.299	23.5
August	2,180.8	.591	.915	4.34	1.055	24.3
September	988.6	.277	.428	2.61	.478	18.3
October	1,954.9	.530	.820	3.95	.945	23.9
November	2,675.6	.749	1.160	2.25	1.294	57.5
December	2,930.7	.794	1.229	4.26	1.417	33.3
The year	45,281.4	1.043	1.613	49.08	21.894	44.6
1897-1906.						
January	43,398.4	1.177	1.820	3.76	2.098	55.8
February	46,781.4	1.399	2.164	3.75	2.262	60.2
March	111,969.4	3.035	4.696	4.94	5.413	109.6
April	88,208.7	2.471	3.822	4.17	4.265	102.2
May	46,487.3	1.260	1.949	3.50	2.248	64.2
June	32,706.7	.916	1.417	4.60	1.582	34.4
July	19,658.7	.533	.825	4.64	.951	20.5
August	19,194.2	.520	.805	4.43	.928	21.1
September	15,590.1	.437	.675	3.78	.754	20.0
October	21,432.1	.581	.899	3.58	1.036	28.9
November	28,836.4	.808	1.249	3.49	1.394	39.9
December	53,683.2	1.455	2.251	4.71	2.596	55.1
The period	527,946.6	1.215	1.880	49.32	25.527	51.8

[a] Total per month for 1906; average of totals per calendar month 1897-1906.

BLACKSTONE RIVER DRAINAGE BASIN.

BLACKSTONE RIVER NEAR WOONSOCKET, R. I.

A gaging station was established on Blackstone River near Woonsocket, R. I., April 5, 1904. During 1905 it was found that the flow was considerably influenced by backwater from the dam at Woonsocket, and the station was discontinued December 31, 1905. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 109, where are given also references to publications that contain data for previous years.

CONNECTICUT RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Connecticut River has its source in Connecticut Lake in northern New Hampshire. Its extreme headwaters, however, lie in the Province of Quebec and in the mountains on the northern boundary of New Hampshire; thence the river flows in a southerly direction between New Hampshire and Vermont and through Massachusetts and Connecticut into Long Island Sound. The total drainage area is 11,085 square miles, of which 155 square miles lie in the Province of Quebec.

Its total length from Connecticut Lake to Long Island Sound is 345 miles. Water power is used at several points, notably at Windsor Locks, Conn.; Holyoke and Turners Falls, Mass.; and Bellows Falls and Wilder, Vt.

The drainage areas of the river and of several of its tributaries are given in Water-Supply Paper No. 165, page 114.

CONNECTICUT RIVER NEAR ORFORD, N. H.

This station was established August 6, 1900. It is located at the wooden highway bridge between Orford, N. H., and Fairlee, Vt., and is about 75 miles from the source of the stream. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 115, where are given also references to publications that contain data for previous years. Length of chain changed October 4, 1906, to 42.80 feet, owing to movement of bridge to which it is attached.

Discharge measurements of Connecticut River near Orford, N. H., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.[a]	Gage height.[b]	Thickness of ice.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Feet.*	*Feet.*	*Sec.-ft.*
February 8	T. W. Norcross	327	1,920	6.84	6.99	1.48	2,250
February 15	Norcross and Adams	327	1,870	6.80	6.80	1.48	2,240
February 17	do	327	1,790	6.56	6.58	1.52	2,040
March 14	Barrows and Norcross	327	1,560	6.00	6.11	1.55	1,680
March 15	T. W. Norcross	327	1,440	5.59	5.70	1.55	1,490

[a] To water surface. [b] To top of ice.

Daily gage height, in feet, of Connecticut River near Orford, N. H., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	[a]8.0	9.8	.....	[a]11.3	9.3	13.9	6.5	5.5	4.5	2.8	5.6	5.6
2	[a]11.0	8.7	.....	[a]10.1	9.9	12.3	6.5	5.5	3.9	2.9	5.5	5.5
3	[a]12.7	7.8	.....	[a]9.9	12.4	10.6	6.3	5.5	4.2	3.1	4.8	5.3
4	[a]11.3	[a]7.7	6.8	[a]9.5	13.9	9.3	5.9	4.5	6.1	3.8	4.5	5.0
5	[a]9.2	[a]7.4	.....	[a]11.7	13.7	9.9	6.1	3.9	5.8	3.9	4.5	5.0
6	[a]8.1	.....	.....	[a]11.9	13.0	9.8	6.2	4.3	5.5	3.6	4.3	4.8
7	[a]7.4	.....	.....	[a]12.7	12.8	10.7	5.9	3.7	4.9	3.1	4.2	4.7
8	.....	6.85	.....	[a]11.9	12.5	11.4	5.5	3.6	4.5	3.1	4.0	4.2
9	.....	.....	6.4	[a]11.3	11.6	12.3	5.4	3.9	4.3	3.4	3.9	4.3
10	.....	7.1	.....	[a]11.1	13.3	11.9	4.9	3.9	4.3	4.2	3.7	4.3
11	.....	.....	6.4	[a]10.5	14.1	10.8	5.5	3.6	3.6	4.3	3.9	4.4
12	[a]5.9	7.0	.....	[a]9.9	13.7	9.4	5.5	3.1	3.9	5.8	4.0	4.5
13	.....	.....	.....	[a]9.8	13.1	8.9	5.6	3.5	4.0	6.6	3.7	.....
14	5.9	.....	6.0	[a]9.8	15.7	8.5	5.1	3.1	3.5	6.2	4.0	.....
15	.....	6.8	5.6	14.8	16.2	7.9	4.9	3.2	3.4	5.7	4.3	.....
16	.....	.....	.....	21.4	15.4	7.4	5.0	2.9	3.3	5.1	4.5	[a]4.8
17	.....	.....	.....	21.6	16.4	6.8	4.5	3.0	3.5	4.9	4.0	.....
18	.....	6.6	5.7	21.4	16.6	6.4	4.3	3.1	3.3	4.5	3.7	.....
19	.....	.....	.....	20.2	13.7	6.1	4.0	3.2	3.2	4.6	5.0	.....
20	.....	.....	.....	19.1	13.1	5.8	4.0	3.4	3.0	4.1	5.7	.....
21	5.9	.....	.....	18.4	12.3	6.2	3.9	2.9	2.7	5.1	6.4	.....
22	[a]6.9	.....	.....	18.7	11.3	6.5	4.5	3.0	2.8	5.4	7.1	.....
23	[a]10.0	.....	.....	17.9	10.1	6.9	5.1	2.9	2.7	6.3	6.7	[a]5.0
24	17.7	.....	.....	15.4	9.8	7.2	4.8	3.0	2.9	6.7	6.4	.....
25	20.2	8.4	5.2	13.7	9.4	6.9	4.4	2.9	3.0	6.6	6.1	.....

[a] To top of ice.

Daily gage height, in feet, of Connecticut River near Orford, N. H., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26	19.0	.....	.....	11.6	12.0	6.7	4.0	3.3	2.9	6.9	6.3	.....
27	17.4	.....	.....	10.9	13.2	6.4	4.5	4.5	2.8	7.4	6.3	.....
28	14.9	.....	.....	10.5	18.6	6.2	4.5	6.5	2.8	7.2	6.4	.....
29	12.7	.....	[a] 11.6	9.9	20.4	5.9	4.0	6.0	2.9	6.9	6.5	.....
30	11.2	.....	[a] 12.0	9.4	16.9	6.0	4.6	5.9	2.8	6.7	5.9	4.8
31	10.4	.....	[a] 12.1	.....	15.8	.....	5.2	5.0	.....	6.7	.....	.....

[a] To top of ice.

NOTE.—The following ice conditions prevailed during 1906: River frozen over January 1 to 23; ice went out January 24. Frozen over at gage February 3; right channel open about 100 feet wide; left channel frozen over: river entirely covered with ice above the bridge. River entirely frozen over at gage about March 1; ice went out about April 15. River frozen over December 12 to 31. During the frozen period gage heights were taken to water surface through a hole in the ice. The following comparative readings were taken:

Comparative ice and water readings.

Date.	Water surface.	Top of ice.	Thickness of ice.	Date.	Water surface.	Top of ice.	Thickness of ice.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*	*Feet.*
January 14	5.9	6.1	0.7	March 9	6.4	6.5	.....
January 21	5.9	5.9	.8	March 11	6.4	6.5	1.5
February 8	6.85	7.0	1.5	March 14	6.0	6.1	1.55
February 15	6.8	6.85	1.5	March 15	5.6	5.7	1.55
February 18	6.6	6.6	1.5	March 18	5.7	5.9	1.6
February 25	8.4	8.6	1.5	March 25	5.2	5.4	1.7
March 4	6.8	6.9	1.5	December 30	4.8	4.9	.7

Rating table for Connecticut River near Orford, N. H.

FOR OPEN-CHANNEL CONDITIONS FROM 1904 TO 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.70	950	4.20	1,880	5.70	3,170	10.00	8,250
2.80	1,000	4.30	1,950	5.80	3,270	11.00	9,700
2.90	1,050	4.40	2,030	5.90	3,370	12.00	11,200
3.00	1,100	4.50	2,110	6.00	3,470	13.00	12,770
3.10	1,160	4.60	2,190	6.20	3,680	14.00	14,340
3.20	1,220	4.70	2,270	6.40	3,900	15.00	15,910
3.30	1,280	4.80	2,350	6.60	4,120	16.00	17,480
3.40	1,340	4.90	2,430	6.80	4,340	17.00	19,050
3.50	1,400	5.00	2,520	7.00	4,560	18.00	20,620
3.60	1,460	5.10	2,610	7.20	4,780	19.00	22,190
3.70	1,530	5.20	2,700	7.40	5,000	20.00	23,760
3.80	1,600	5.30	2,790	7.60	5,220	21.00	25,330
3.90	1,670	5.40	2,880	7.80	5,440	22.00	26,900
4.00	1,740	5.50	2,970	8.00	5,660		
4.10	1,810	5.60	3,070	9.00	6,900		

UNDER ICE COVER FOR 1906.[b]

3.60	1,210	4.60	1,740	5.60	2,400	6.60	3,140
3.80	1,300	4.80	1,860	5.80	2,640	6.80	3,300
4.00	1,400	5.00	1,990	6.00	2,680	7.00	3,460
4.20	1,500	5.20	2,120	6.20	2,830	8.00	4,290
4.40	1,620	5.40	2,260	6.40	2,980		

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1900-1906, and is well defined below gage height 12 feet. Above gage height 12 feet the rating curve is a tangent, the difference being 157 per tenth.

[b] This table is applicable only for ice-cover conditions. It is based upon fourteen discharge measurements made during 1904-1906, and is well defined between gage heights 4 feet and 5.5 feet. Gage heights are to bottom of ice. Above gage height 8 feet 75 per cent of the open-channel rating was used.

Monthly discharge of Connecticut River near Orford, N. H., for 1906.

[Drainage area, 3,300 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	21,600	2,055	6,360	1.93	2.22
February	7,170	2,055	3,030	.918	.96
March	6,800	1,255	2,240	.679	.78
April	26,300	4,300	11,800	3.58	3.99
May	24,400	7,290	13,700	4.15	4.78
June	14,200	3,270	6,540	1.98	2.21
July	4,010	1,670	2,630	.797	.92
August	4,010	1,050	1,790	.542	.62
September	3,570	950	1,600	.485	.54
October	5,000	1,000	2,760	.836	.96
November	4,670	1,530	2,670	.809	.90
December	3,070	1,500	1,960	.594	.68
The year	26,300	950	4,760	1.44	19.56

NOTE.—Values are rated as follows: January to March and December, fair; April, good; May to November, excellent.

CONNECTICUT RIVER AT SUNDERLAND, MASS.

This station was established March 31, 1904. It is located at a five-span steel highway bridge, with a total length of about 830 feet, at Sunderland. The nearest railway station is at South Deerfield. The gaging station is about 18 miles above the dam at Holyoke and about 5 miles below that at Turners Falls. The conditions at the station and the bench marks are described in Water-Supply Paper No. 165, page 118, where are given also references to publications that contain data for previous years. Length of chain changed to 42.84 feet on April 24, 1906.

Discharge measurements of Connecticut River at Sunderland, Mass., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 25	T. W. Norcross	776	10,700	14.54	40,400
August 9	G. M. Brett	692	2,830	4.04	5,320
October 6	F. E. Pressey	563	1,435	2.05	2,030

Daily gage height, in feet, of Connecticut River at Sunderland, Mass., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	8.2	7.4	8.75	10.45	9.35	13.15	6.0	5.3	4.1	2.45	4.2	5.0
2	7.9	7.1	7.7	9.4	9.35	10.9	8.0	5.25	3.55	2.0	4.1	4.75
3	7.05	8.0	7.25	8.5	10.5	9.4	7.75	4.9	3.3	2.3	3.95	4.2
4	6.75	6.9	10.0	8.5	11.8	9.0	7.3	5.0	3.0	2.5	3.8	4.8
5	7.2	7.25	11.45	9.8	11.4	8.7	7.0	5.0	2.9	2.35	3.6	4.75
6	7.5	7.4	9.85	11.4	10.6	8.2	6.7	4.55	3.2	2.2	3.65	4.7
7	7.25	.....	8.7	11.8	10.35	8.1	6.1	4.3	3.4	1.6	3.45	4.7
8	7.05	.....	7.95	10.7	10.25	8.6	5.5	4.35	3.3	2.35	3.4	4.85
9	6.85	.....	7.75	10.0	9.8	9.9	5.1	4.05	3.2	2.45	3.3	.....
10	6.7	.....	7.1	9.6	11.1	10.2	4.75	3.65	3.2	2.7	3.25	.....
11	6.5	.....	5.8	9.4	12.1	10.0	4.8	3.35	3.0	2.75	3.1	.....
12	6.55	.....	5.4	10.2	11.7	9.4	4.8	3.3	2.8	3.0	3.2	.....
13	7.15	.....	4.9	11.5	10.9	8.6	4.85	3.2	2.9	2.9	3.5	.....
14	7.5	.....	4.85	12.5	11.0	7.7	4.75	3.1	2.7	3.2	3.6	.....
15	7.25	.....	5.0	16.2	12.1	7.0	4.4	3.1	2.65	3.8	3.6	4.6

Daily gage height, in feet, of Connecticut River at Sunderland, Mass., for 1906—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Jnly.	Aug.	Sept.	Oct	Nov.	Dec.
16	7.2	.....	6.05	23.1	11.8	6.2	4.1	3.05	2.25	3.9	3.6	.....
17	7.6	6.6	6.4	22.8	11.2	5.9	3.75	3.05	2.6	3.55	3.45	.....
18	7.6	.....	5.3	21.0	10.55	6.5	4.3	2.8	2.3	3.3	3.45	.....
19	7.5	.....	4.45	19.65	9.85	7.6	4.9	2.3	2.45	3.2	4.5	.....
20	7.1	.....	5.6	18.85	9.3	7.5	4.5	2.5	2.4	3.35	6.5	.....
21	6.9	.....	6.0	17.9	9.1	6.8	4.0	2.25	2.4	4.75	6.8	.....
22	7.1	.....	4.9	16.9	8.8	6.1	3.9	2.6	2.55	4.5	6.9	4.8
23	10.75	.....	4.25	16.3	8.2	5.5	4.4	3.35	2.3	4.5	7.0	.....
24	15.55	.....	4.0	15.7	7.55	6.0	4.5	2.8	2.8	4.4	6.75	.....
25	17.6	.....	4.0	14.4	7.05	7.5	4.55	2.8	2.4	4.3	6.2	.....
26	14.3	.....	3.75	12.8	7.25	7.6	4.3	2.5	2.5	4.5	5.55	.....
27	12.6	10.6	4.1	11.1	8.0	7.1	3.95	2.9	2.55	4.7	5.4	.....
28	11.35	9.8	7.7	10.5	15.4	6.4	3.65	2.85	2.45	5.0	5.45	.....
29	10.2	.....	10.4	9.45	21.1	5.95	3.65	2.9	2.35	5.0	5.45	4.75
30	8.65	.....	10.9	9.2	19.75	5.4	4.1	4.2	1.85	4.9	5.5	.....
31	7.7	.....	10.7	.....	16.3	.....	4.7	4.45	.....	4.5	.....	.....

NOTE.—The river froze over February 7 and cleared of ice the afternoon of February 27. On March 24 the river was frozen over, beginning about 500 feet above the gage, but was open at and below the bridge; this ice went out March 28. River frozen December 4 to 31. During the frozen period gage heights were taken to water surface through a hole in the ice. The following comparative readings were taken:

Comparative ice and water readings.

Date.	Water surface.	Top of ice.	Thickness of ice.	Date.	Water surface.	Top of ice.	Thickness of ice.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*	*Feet.*
February 7	.....	7.3	.....	February 24	.....	9.9	.....
February 10	.....	6.9	.....	December 22	4.8	4.85	0.5
February 17	6.6	6.6	0.7	December 29	4.75	4.8	.6

Rating table for Connecticut River at Sunderland, Mass., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.60	1,630	3.00	3,350	4.40	6,200	6.60	12,100
1.70	1,710	3.10	3,520	4.50	6,430	6.80	12,710
1.80	1,800	3.20	3,700	4.60	6,670	7.00	13,340
1.90	1,900	3.30	3,880	4.70	6,910	7.20	13,980
2.00	2,000	3.40	4,070	4.80	7,150	7.40	14,630
2.10	2,110	3.50	4,270	4.90	7,400	7.60	15,290
2.20	2,220	3.60	4,470	5.00	7,650	7.80	15,970
2.30	2,340	3.70	4,670	5.20	8,170	8.00	16,650
2.40	2,470	3.80	4,880	5.40	8,690	9.00	20,200
2.50	2,600	3.90	5,090	5.60	9,210	10.00	23,850
2.60	2,740	4.00	5,300	5.80	9,780	11.00	27,550
2.70	2,880	4.10	5,520	6.00	10,340	12.00	31,250
2.80	3,030	4.20	5,740	6.20	10,920	13.00	34,950
2.90	3,190	4.30	5,970	6.40	11,500		

NOTE.—The above table is applicable only for open-channel conditions. It is based on three discharge measurements made during 1906, and the form of previous curves. It is well defined between gage heights 2 feet and 20 feet. Above gage height 9.5 feet the rating curve is a tangent, the difference being 370 per tenth.

Monthly discharge of Connecticut River at Sunderland, Mass., for 1906.

[Drainage area, 7,700 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April	72,300	18,400	36,100	4.69	5.23
May	64,900	13,500	27,800	3.61	4.16
June	35,500	8,690	16,600	2.16	2.41
July	16,600	4,570	7,880	1.02	1.18
August	8,430	2,280	4,540	.590	.68
September	5,520	1,850	3,070	.399	.45
October	7,650	1,630	4,430	.575	.66
November	13,300	3,520	6,820	.886	.99

NOTE.—Values are rated as follows: April, good; May to November, excellent.

CONNECTICUT RIVER AT HARTFORD, CONN.

Daily readings of the height of water at Hartford have been recorded since February 8, 1896, by Edwin Dwight Graves, chief engineer of the Connecticut River bridge and highway district, and through his courtesy have been furnished to the United States Geological Survey.

The conditions at this station and the bench marks are described in Water-Supply Paper No. 165, page 121, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Connecticut River at Hartford, Conn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.4	6.1	5.6	10.8	7.7	15.6	4.1	3.4	2.6	0.7	2.8	3.9
2	5.1	5.7	7.0	10.0	7.7	12.3	5.1	3.5	2.0	1.4	2.4	2.7
3	5.1	4.0	7.0	8.8	7.8	9.6	6.5	3.3	1.8	1.7	2.5	2.6
4	5.6	4.7	10.2	7.7	9.0	8.0	6.6	3.0	1.5	1.8	1.5	1.7
5	5.0	4.2	12.0	7.8	9.7	7.4	6.0	3.0	2.0	1.9	2.0	3.0
6	5.1	3.7	9.7	9.6	9.1	7.0	5.6	3.1	1.8	1.9	2.7	2.9
7	4.3	4.4	7.3	11.0	8.8	6.7	5.2	3.1	1.7	1.4	2.3	2.3
8	4.0	4.0	6.1	10.5	8.8	6.7	4.5	3.0	2.0	.8	2.2	3.3
9	4.9	4.0	5.5	9.6	8.5	7.0	4.2	3.1	1.8	1.6	2.4	3.2
10	5.5	4.1	5.1	10.6	8.4	7.9	3.9	3.0	1.9	2.2	3.0	3.2
11	5.5	2.9	4.3	11.4	9.6	8.3	3.7	3.0	2.0	2.5	2.9	4.3
12	5.1	3.6	4.5	11.6	10.0	8.0	3.6	2.0	2.6	1.9	3.5	3.7
13	5.0	4.2	4.4	11.5	9.5	7.3	3.4	2.2	2.8	2.3	3.5	3.9
14	5.5	4.2	4.0	11.5	8.9	6.5	3.3	2.9	2.8	1.9	3.5	3.9
15	6.1	4.4	4.0	12.0	9.2	5.7	3.1	2.7	2.2	2.6	3.5	3.7
16	6.3	4.0	3.7	17.6	9.7	5.2	3.1	2.6	2.8	3.6	3.3	2.8
17	6.6	3.9	3.5	20.0	9.4	4.8	3.1	2.4	1.7	3.2	2.3	2.8
18	6.4	3.6	3.9	20.1	8.9	4.8	2.8	1.8	1.6	2.7	1.6	3.9
19	6.2	3.7	3.8	19.1	8.3	5.5	2.8	1.2	1.5	2.9	2.2	3.7
20	5.7	4.0	4.0	18.0	7.4	6.2	3.1	.8	1.4	2.5	4.5	3.6
21	5.0	4.0	2.7	17.1	7.1	5.9	3.0	1.5	1.8	3.2	5.2	3.8
22	5.0	5.2	3.8	16.1	7.0	5.2	2.1	2.0	1.7	4.2	5.5	3.8
23	5.4	7.2	3.2	15.2	6.6	4.6	2.3	1.9	1.7	3.9	5.2	3.2
24	9.0	7.4	2.5	14.5	6.0	4.0	2.9	1.7	1.2	3.8	5.0	3.0
25	14.4	6.7	1.8	13.7	5.5	4.5	2.8	1.7	2.2	4.7	4.7	2.8
26	14.1	6.9	2.5	12.5	5.2	5.5	2.9	1.8	2.4	4.3	4.4	2.7
27	12.0	7.0	3.2	11.1	5.3	5.5	2.9	2.1	2.8	4.5	4.3	3.3
28	10.4	6.2	4.7	9.5	7.3	5.1	2.9	2.4	2.4	4.1	4.1	3.2
29	9.2	.....	9.6	8.4	15.9	4.6	2.4	2.8	2.8	3.3	3.5	3.3
30	8.0	.....	10.8	7.8	19.0	4.3	2.9	3.0	1.8	3.5	4.0	2.6
31	6.8	.....	10.8	.....	18.2	.....	3.2	3.0	.....	3.1	.....	2.8

ISRAEL RIVER (ABOVE SOUTH BRANCH) NEAR JEFFERSON HIGHLAND, N. H.

This station was established September 2, 1903. It is located at a small wooden highway bridge in the town of Randolph, about half-way between the railway stations of Jefferson Highland and Bowman, 2½ miles from either place. The conditions and the bench marks are described in New Hampshire Forestry Reports for 1903–1906. and in Water-Supply Paper No. 165, page 123, where are given also references to publications that contain data for previous years. During 1906 gage was read by William Russell. Length of chain changed October 1, 1906, to 15.35 feet. Elevation of bench mark. 8.50 feet above datum of gage.

Discharge measurements of Israel River (above South Branch) near Jefferson Highland, N. H., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 1	T. W. Norcross	25	33	1.83	48
August 22	G. M. Brett	9.2	5.0	1.03	4.2
August 22	do	9.2	4.9	1.03	4.1
October 1 [a]	F. E. Pressey	18	12.8	1.13	6.5

[a] By wading about 20 feet above bridge.

Daily gage height, in feet, of Israel River (above South Branch) near Jefferson Highland, N. H., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.73	1.6	1.4	1.15	1.2	1.2	17	1.7	1.4	1.2	1.05	1.15	.....
2	1.6	1.5	1.35	1.1	1.2	1.15	18	2.0	1.5	1.35	1.0	1.15	.....
3	1.95	1.9	1.35	1.05	1.85	1.15	19	2.25	1.45	1.2	1.0	1.15	.....
4	1.7	1.6	1.45	1.05	1.5	1.15	20	1.6	1.4	1.15	1.0	1.1	.....
5	2.15	1.9	1.45	1.05	1.3	1.15	21	1.7	1.35	1.15	1.05	1.1	.....
6	1.8	1.7	1.35	1.05	1.25	1.1	22	1.6	1.3	1.35	1.05	1.1	.....
7	1.7	2.4	1.3	1.45	1.2	1.1	23	1.65	1.3	1.3	1.05	1.15	.....
8	1.6	2.0	1.3	1.2	1.2	1.3	24	1.75	1.6	1.25	1.2	1.1	.....
9	1.5	1.9	1.3	1.15	1.25	1.15	25	1.75	1.45	1.2	1.1	1.1	.....
10	1.8	1.95	1.3	1.1	1.35	1.75	26	2.2	1.45	1.2	1.05	1.1	.....
11	1.5	1.75	1.45	1.1	1.2	1.3	27	3.0	1.4	1.2	1.15	1.1	.....
12	1.55	1.7	1.3	1.05	1.15	1.3	28	2.6	1.35	1.15	1.95	1.1	.....
13	2.75	1.65	1.3	1.05	1.2	.....	29	2.5	1.45	1.25	1.45	1.05	.....
14	1.9	1.6	1.25	1.0	1.2	.....	30	2.3	1.4	1.35	1.2	1.15	.....
15	1.7	1.55	1.2	1.05	1.2	.....	31	1.6	.....	1.3	1.2	.....	.....
16	1.6	1.4	1.15	1.05	1.2	.....							

Rating table for Israel River (above South Branch) near Jefferson Highland, N. H., for 1903–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	3.0	1.60	30	2.10	79	2.60	158
1.10	5.3	1.70	38	2.20	93	2.70	176
1.20	8.6	1.80	46	2.30	108	2.80	194
1.30	13	1.90	55	2.40	124	2.90	212
1.40	18	2.00	67	2.50	140	3.00	230
1.50	24						

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1906 and is fairly well defined below gage heights 2.4 feet.

Monthly discharge of Israel River (above South Branch) near Jefferson Highlands, N. H., for 1906.

[Drainage area, 8.7 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
May	230	24	63.8	7.33	8.45
June	124	13	33.1	3.80	4.24
July	21	6.8	12.4	1.43	1.65
August	61	3.0	7.84	.901	1.04
September	50	4.0	9.50	1.10	1.23
October (1-12)	42	5.3	11.2	1.29	.58

NOTE.—Values are rated as approximate.

ISRAEL RIVER (BELOW SOUTH BRANCH) NEAR JEFFERSON HIGHLANDS, N. H.

This station was established September 2, 1903. It is located at a small wooden highway bridge about 2 miles from the railway station at Jefferson Highlands, in the town of Jefferson. The conditions and the bench marks are described in New Hampshire Forestry Reports for 1903–1906 and in Water-Supply Paper No. 165, page 125, where are given also references to publications that contain data for previous years. During 1906 the gage was read by William Russell.

Discharge measurements of Israel River (below South Branch) near Jefferson Highlands, N. H., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 1	T. W. Norcross	40	30	1.80	98
August 22 [a]	G. M. Brett	15.6	13	1.07	11.8
October 1 [a]	F. E. Pressey	16	13.9	1.20	14.0

[a] Measured by wading.

Daily gage height, in feet, of Israel River (below South Branch) near Jefferson Highlands, N. H., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.8	1.8	1.5	1.2	1.25	1.2	1.3	1.3
2	1.7	1.75	1.45	1.15	1.2	1.15	1.25	1.4
3	1.9	2.05	1.45	1.15	1.95	1.15	1.25	1.4
4	1.8	1.8	1.5	1.1	1.7	1.15	1.2	1.7
5	2.2	1.7	1.5	1.1	1.4	1.1	1.2	1.7
6	2.0	1.7	1.45	1.1	1.3	1.1	1.2	1.8
7	1.9	2.2	1.35	1.6	1.25	1.1	1.15	1.8
8	1.7	1.8	1.35	1.35	1.2	1.25	1.2	1.8
9	1.65	1.8	1.35	1.2	1.25	1.1	1.2	1.8
10	2.0	1.7	1.4	1.15	1.45	1.7	1.2	1.8
11	1.65	1.75	1.45	1.15	1.3	1.3	1.2	1.8
12	1.65	1.65	1.4	1.15	1.25	1.3	1.2	1.8
13	2.8	1.6	1.35	1.15	1.2	1.25	1.2	1.8
14	2.05	1.55	1.3	1.1	1.2	1.25	1.2	1.8
15	1.8	1.5	1.25	1.1	1.2	1.25	1.5	1.9

Daily gage height, in feet, of Israel River (below South Branch) near Jefferson Highlands, N. H., for 1906—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	1.8	1.45	1.2	1.1	1.2	1.2	1.4	1.7
17	1.9	1.45	1.2	1.05	1.15	1.2	1.2	1.6
18	2.05	1.5	1.35	1.05	1.15	1.2	1.2	1.6
19	2.25	1.5	1.2	1.05	1.15	1.2	1.9	1.55
20	1.8	1.45	1.2	1.05	1.15	1.45	1.45	1.55
21	1.85	1.4	1.2	1.15	1.15	1.35	1.4	1.5
22	1.6	1.35	1.45	1.15	1.15	1.3	1.3	1.5
23	1.55	1.35	1.25	1.1	1.2	1.25	1.2	1.4
24	1.6	1.7	1.25	1.3	1.15	1.25	1.2	1.5
25	1.7	1.55	1.25	1.1	1.15	1.25	[a] 1.3	1.4
26	2.2	1.5	1.2	1.1	1.15	1.45	1.3	1.4
27	2.95	1.45	1.15	1.1	1.15	1.35	1.3	1.5
28	2.6	1.4	1.15	2.0	1.15	1.3	1.3	1.5
29	2.2	1.45	1.1	1.45	1.1	1.25	1.4	1.5
30	2.05	1.4	1.35	1.2	1.2	1.25	1.3	1.4
31	1.9	.....	1.3	1.0	.....	1.2	.....	1.5

[a] Ice jam below gage, discharge corrected.

NOTE.—The river was frozen December 2 to 14 and 27 to 29. Records for November and December are of doubtful value on account of anchor ice in the river and of jams of anchor ice and masses of snow.

Rating table for Israel River (below South Branch) near Jefferson Highlands, N. H., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	10	1.60	66	2.20	211	2.80	385
1.10	15	1.70	84	2.30	240	2.90	414
1.20	21	1.80	105	2.40	269	3.00	443
1.30	29	1.90	128	2.50	298		
1.40	39	2.00	154	2.60	327		
1.50	51	2.10	182	2.70	356		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1906, and it is well defined between gage heights 0.9 foot and 2.6 feet.

Monthly discharge of Israel River (below South Branch) near Jefferson Highlands, N. H., for 1906.

[Drainage area, 21.2 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
May	428	58	149	7.03	8.10
June	211	34	73.1	3.45	3.85
July	51	15	32.1	1.51	1.74
August	154	10	24.0	1.13	1.30
September	141	15	28.3	1.33	1.48
October	84	15	26.5	1.25	1.44
November	128	21	28.3	1.33	1.48

NOTE.—Values are rated as fair.

AMMONOOSUC RIVER AT BRETTON WOODS, N. H.

This station was established August 28, 1903. It is located at the steel highway bridge near Mount Pleasant House, at Bretton Woods. The conditions and the bench marks are described in New Hampshire Forestry Reports for 1903–1906, and in Water-Supply Paper No. 165, page 128, where are given also references to publications that contain data for previous years.

Discharge measurements of Ammonoosuc River near Bretton Woods, N. H., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
May 4	T. W. Norcross	40	157	3.61	534
July 5	Murphy and Barrows	38	83	1.80	54
August 1 [a]	T. W. Norcross	40	106	2.40	129
August 4	do	39	89	1.93	62
August 24 [b]	do	30	27.6	1.58	31.6
October 27 [c]	do	24	28.5	1.57	30.4
1906.					
May 2	T. W. Norcross	40	117	2.50	159
August 21	G. M. Brett	27.5	22	1.51	21
October 1	F. E. Pressey	31	34	1.65	25

[a] Meter in poor condition.
[b] By wading, 150 above gage; meter fastened to a rod.
[c] From upstream side of highway bridge.

Daily gage height, in feet, of Ammonoosuc River at Bretton Woods, N. H., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.55	1.75	.....	1.80	2.84	2.58	2.58	1.68	1.62	1.68	1.85	1.90
2	1.55	1.75	.....	1.54	2.58	2.55	2.38	1.62	1.60	1.62	1.85	1.90
3	1.55	1.75	.....	1.52	3.05	2.80	1.95	1.52	1.92	1.60	1.82	.....
4	1.58	1.75	.....	1.54	2.85	2.58	2.68	1.50	2.10	1.52	1.80	.....
5	1.60	1.75	.....	1.70	3.15	2.40	2.30	1.50	1.80	1.50	1.80	.....
6	1.60	.....	.....	1.70	2.82	2.75	2.08	1.65	1.68	1.55	1.80	1.80
7	1.60	.....	1.60	1.54	2.72	3.10	1.95	1.72	1.62	1.80	1.80	.....
8	1.60	.....	1.50	1.52	2.55	2.72	1.88	1.62	1.60	1.70	1.80	1.70
9	1.55	1.70	1.50	1.52	2.68	2.52	1.85	1.55	1.60	1.75	1.78	.....
10	1.55	1.60	1.50	1.52	2.95	2.35	1.90	1.50	2.10	2.15	1.75	1.70
11	1.50	.....	1.50	1.47	2.60	2.28	1.88	1.50	1.75	1.98	1.72	.....
12	1.50	.....	.....	1.47	2.52	2.22	1.82	1.50	1.62	1.88	1.70	1.70
13	1.50	.....	.....	1.60	3.80	2.10	1.78	1.50	1.60	1.85	1.70	.....
14	1.50	.....	.....	1.77	2.98	2.02	1.72	1.50	1.60	1.85	1.70	.....
15	1.52	1.50	1.50	3.37	2.85	1.98	1.75	1.48	1.60	1.80	1.75	1.75
16	1.62	.....	.....	3.20	2.78	1.92	1.75	1.45	1.60	1.78	1.80	.....
17	1.58	1.50	.....	2.87	2.70	2.05	1.72	1.42	1.60	1.75	1.78	1.68
18	1.55	.....	.....	2.77	2.60	2.18	1.72	1.40	1.58	1.75	1.75	1.65
19	1.55	.....	.....	2.80	2.58	2.02	1.62	1.40	1.52	1.75	2.52	1.65
20	1.55	1.50	.....	2.92	2.52	1.95	1.60	1.42	1.50	2.85	2.30	1.65
21	1.55	1.58	1.35	3.27	2.48	1.85	1.88	1.50	1.50	2.15	2.00	1.65
22	2.45	1.80	1.35	2.94	2.42	1.85	1.88	1.48	1.52	2.02	1.98	1.65
23	3.68	1.70	1.38	2.62	2.30	1.88	1.80	1.68	1.60	1.98	1.95	1.62
24	3.75	1.58	1.40	2.42	2.35	2.25	1.75	1.82	1.50	1.92	1.90	1.60
25	2.50	1.58	1.40	2.10	3.08	2.05	1.62	1.62	1.45	2.53	1.88	1.60

Daily gage height, in feet, of Ammonoosuc River at Bretton Woods, N. H., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26	2.25	1.70	1.40	2.07	2.78	1.98	1.58	1.58	1.45	2.28	1.85	1.58
27	2.15	1.62	1.58	2.07	4.65	1.88	1.52	2.20	1.60	2.10	2.02	1.55
28	2.05	.....	2.08	2.02	4.20	1.75	1.50	2.70	1.62	2.08	2.12	1.55
29	1.85	.....	1.70	2.17	3.55	2.48	1.50	1.95	1.52	2.02	1.98	1.55
30	1.80	.....	1.70	2.82	2.80	2.58	1.95	1.75	1.90	1.98	1.92	1.55
31	1.80	.....	1.68	.....	2.70	.....	1.95	1.70	.....	1.95	.....	1.55

NOTE.—The following ice conditions prevailed during 1906: River open January 1 to February 5; frozen most of the time from February 5 to March 21, except in narrow strips just above and below gage. Ice went out about March 21. Anchor ice reported on April 1 and 5 and on December 2. During the frozen period gage heights were taken to water surface through a hole in the ice. The following comparative readings were taken:

Comparative ice and water readings.

Date.	Water surface.	Top of ice.	Thickness of ice.	Date.	Water surface.	Top of ice.	Thickness of ice.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*	*Feet.*
February 9	1.7	2.1	0.4	December 8, 10, 12	1.7	.....	0.6
February 10	1.6	2.1	.4	December 15	1.75	.....	.45
February 15	1.5	1.75	.35	December 17	1.68	.....	.45
February 17	1.5	1.95	.4	December 18-20	1.65	.....	.4
March 15	1.5	1.75	.35	December 21	1.65	.....	.35
December 6	1.8	.....	.45				

Rating table for Ammonoosuc River at Bretton Woods, N. H.

JANUARY 1 TO DECEMBER 31, 1905.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	20	2.00	75	2.60	185	3.20	388
1.50	26	2.10	88	2.70	213	3.30	428
1.60	33	2.20	103	2.80	243	3.40	469
1.70	42	2.30	120	2.90	275	3.50	510
1.80	52	2.40	139	3.00	310	3.60	552
1.90	63	2.50	160	3.10	348		

JANUARY 1 TO DECEMBER 31, 1906.[b]

1.40	15	2.30	118	3.20	388	4.00	726
1.50	20	2.40	138	3.30	428	4.10	770
1.60	27	2.50	160	3.40	469	4.20	815
1.70	36	2.60	185	3.50	510	4.30	860
1.80	46	2.70	213	3.60	552	4.40	905
1.90	57	2.80	243	3.70	595	4.50	950
2.00	70	2.90	275	3.80	638	4.60	995
2.10	84	3.00	310	3.90	682	4.70	1,040
2.20	100	3.10	348				

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905 and is fairly well defined.

[b] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1906 and is not well defined.

Monthly discharge of Ammonoosuc River at Bretton Woods, N. H., for 1905-6.

[Drainage area, 34 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
March (21-31)	544	26	256	7.53	3.08
April	282	32	147	4.32	4.82
May	531	75	192	5.65	6.51
June	228	35	86.7	2.55	2.84
July	329	20	47.6	1.40	1.61
August	228	33	69.1	2.03	2.34
September	213	47	86.7	2.55	2.84
October	111	29	41.0	1.21	1.40
November	88	17	29.1	.856	.955
December (1-15)	199	26	58.0	1.71	.954
1906.					
March (21-31)	81	13	27.1	.797	.326
April	457	18	132	3.88	4.33
May	1,020	118	290	8.53	9.83
June	348	41	122	3.59	4.00
July	207	20	59.6	1.75	2.02
August	213	15	34.6	1.02	1.18
September	84	17	32.5	.956	1.07
October	259	20	64.8	1.91	2.20
November	165	36	57.3	1.69	1.89

NOTE.—Values for 1905 are rated as follows: March to September and December, fair; October and November, approximate. Values for 1906 are rated as follows: March and September to November, approximate; April to August, good.

ZEALAND RIVER NEAR TWIN MOUNTAIN, N. H.

This station was established August 29, 1903. It is located about 800 feet above the mouth of the river, which empties into the Ammonoosuc at a point midway between Fabyans and Twin Mountain, about 2½ miles from either place. The conditions at the station and the bench marks are described in New Hampshire Forestry Reports for 1903–6, and in Water-Supply Paper No. 165, page 30, where are given also references to publications that contain data for previous years. Length of chain changed to 12.99 feet, May 2, 1906, and to 12.38 feet, October 3, 1906, on account of settling of one of the trees to which the gage is fastened.

Discharge measurements of Zealand River near Twin Mountain, N. H., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 2	T. W. Norcross	46	37	2.85	96
August 21[a]	G. M. Brett	19.5	12	2.01	6.8
August 21[a]	do	12.2	6.2	2.01	7.6
October 3[a]	F. E. Pressey	25	13.5	2.02	6.4

[a] Measured by wading.

Daily gage height, in feet, of Zealand River near Twin Mountain, N. H., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.45	2.6	2.6	2.35	2.3	2.25	2.5	2.75
2	.....	3.0	2.6	2.45	2.3	2.15	2.25	2.45	.....
3	.....	3.3	2.8	2.25	2.25	2.2	2.8	2.4	.....
4	.....	3.2	2.6	2.65	2.25	2.1	2.6	2.4	.....
5	.....	3.3	2.55	2.55	2.25	2.05	2.3	2.4	.....
6	.....	2.9	3.2	2.45	2.25	2.0	2.3	2.35	.....
7	.....	3.0	3.0	2.35	2.25	2.0	2.5	2.35	.....
8	2.55	2.7	2.9	2.3	2.35	2.0	2.4	2.25	.....
9	2.55	2.9	2.8	2.35	2.3	2.3	2.6	2.25	.....
10	2.55	3.0	2.7	2.4	2.2	2.0	2.8	2.25	.....
11	2.45	2.9	2.7	2.35	2.25	2.0	3.2	2.3	.....
12	2.35	2.8	2.6	2.3	2.25	1.95	3.1	2.35	.....
13	2.25	3.7	2.55	2.25	2.2	1.9	2.9	2.35	.....
14	2.55	3.05	2.5	2.15	2.15	1.9	2.6	2.4	.....
15	4.05	2.9	2.45	2.25	2.2	1.85	2.55	2.5	.....
16	3.55	2.95	2.3	2.3	2.2	2.05	2.5	2.4	.....
17	3.45	2.95	2.5	2.3	2.15	2.05	2.5	2.4	.....
18	3.55	2.9	2.45	2.35	2.1	2.15	2.5	2.5	.....
19	3.35	2.7	2.4	2.3	2.05	2.1	2.45	2.6	.....
20	3.85	2.7	2.3	2.3	2.05	2.05	2.8	2.9	.....
21	4.0	2.5	2.3	2.8	2.15	2.0	2.4	2.8	.....
22	3.15	2.45	2.35	2.5	2.15	2.0	2.8	2.8	.....
23	2.85	2.45	2.4	2.55	2.25	2.25	2.7	2.6	.....
24	2.75	2.5	2.7	2.4	2.2	2.35	2.6	2.5	.....
25	2.75	3.2	2.6	2.35	2.15	2.25	2.9	2.5	.....
26	2.75	2.7	2.45	2.25	2.15	2.25	3.0	2.7	.....
27	2.75	4.0	2.[illegible]5	2.2	3.05	2.15	2.85	2.8	.....
28	2.65	3.8	2.35	2.15	2.65	2.15	2.65	2.9	.....
29	2.70	3.25	2.75	2.2	2.45	2.15	2.6	2.8	.....
30	3.75	2.85	2.7	2.6	2.35	2.35	2.65	2.8	.....
31	.....	2.75	.....	2.5	2.35	.....	2.5	.....	.....

Rating table for Zealand River near Twin Mountain, N. H., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.85	3	2.30	24	2.90	127	3.50	330
1.90	4	2.40	34	3.00	156	3.60	368
1.95	5	2.50	45	3.10	188	3.70	406
2.00	6	2.60	60	3.20	222	3.80	445
2.10	11	2.70	78	3.30	257	3.90	485
2.20	17	2.80	100	3.40	293	4.00	526

NOTE.—The above table is applicable only for open-channel conditions. It is based upon four discharge measurements made during 1906, and is merged with the 1905 table at gage height 2.6 feet. It is fairly well defined.

Monthly discharge of Zealand River near Twin Mountain, N. H., for 1906.

[Drainage area, 14 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April (8-30)	546	20	190	13.57	11.61
May	526	39	169	12.07	13.91
June	222	24	64.8	4.63	5.17
July	100	14	34.2	2.44	2.81
August	172	8	25.8	1.84	2.12
September	29	3	12.2	.871	.97
October	222	24	74.9	5.35	6.17
November	127	20	54.0	3.86	4.31

NOTE.—Values are rated as approximate, owing to settling of gage and erroneous gage heights.

DEERFIELD RIVER AT DEERFIELD, MASS.

This station was established March 29, 1904, at the suspension highway bridge, about one-fourth mile from the West Deerfield railway station and about 6 or 7 miles above the mouth of the river. It was discontinued December 31, 1905. The conditions at this station and the bench marks are described in Water-Supply Paper No. 165, page 134, where are given also references to publications that contain data for previous years.

Discharge measurements of Deerfield River at Deerfield, Mass., in 1904-1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1904.					
March 30	N. C. Grover		2,180	3.61	2,390
April 11	S. K. Clapp		2,500	4.68	5,810
April 25	do		2,480	4.58	5,010
May 18	do		2,270	3.75	3,420
June 1	do		1,920	2.81	590
June 20 [a]	do		449	2.70	850
July 28 [a]	do		259	2.60	513
August 17 [a]	do		168	2.45	275
September 17	T. W. Norcross		2,020	3.21	1,260
October 27	do		2,010	2.90	981
November 30 [ab]	do		288	2.60	531
1905.					
April 4	T. W. Norcross	319	2,270	3.97	3,710
August 16	do	315	2,040	3.29	1,680
August 16	do	318	2,120	3.56	2,290
August 16	do	318	2,140	3.69	2,520
August 17	do	318	2,130	3.68	2,380
August 17	do	318	2,110	3.51	2,000
August 17	do	318	2,100	3.42	1,840
August 31	do	314	2,020	3.12	1,310
1906.					
September 21 [a]	F. E. Pressey	180	110	1.58	85

[a] By wading at different sections.
[b] River frozen at gage 0.1 foot thick. Gage height to bottom of ice.

Rating table for Deerfield River at Deerfield, Mass., for 1904-5.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.20	180	3.20	1,450	4.20	3,900	5.40	8,250
2.30	220	3.30	1,650	4.30	4,200	5.60	9,120
2.40	280	3.40	1,860	4.40	4,510	5.80	10,030
2.50	370	3.50	2,080	4.50	4,830	6.00	10,980
2.60	490	3.60	2,310	4.60	5,170	6.20	11,970
2.70	620	3.70	2,550	4.70	5,520	6.40	12,980
2.80	760	3.80	2,800	4.80	5,880	6.60	14,030
2.90	910	3.90	3,060	4.90	6,250	6.80	15,100
3.00	1,080	4.00	3,330	5.00	6,630	7.00	16,200
3.10	1,260	4.10	3,610	5.20	7,420	7.20	17,300

NOTE.—The above table is applicable only for open-channel conditions. It is based on twenty discharge measurements made during 1904-1906 and is fairly well defined between gage heights 2.5 feet and 5 feet. The rating below gage height 2.5 feet is very uncertain.

Monthly discharge of Deerfield River at Deerfield, Mass., for 1904–5.

[Drainage area, 550 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1904.					
April	10,700	1,550	4,050	7.36	8.21
May	5,340	620	2,270	4.13	4.76
June	11,200	250	1,200	2.18	2.43
July	910	280	411	.747	.86
August	3,200	220	476	.865	1.00
September	9,120	180	915	1.66	1.85
October	5,880	325	983	1.79	2.06
November	760	220	336	.611	.68
1905.					
January 7-13	17,300	1,760	5,000	9.09	2.37
March 27-31	14,000	8,460	10,900	19.80	3.68
April	9,340	1,260	3,380	6.15	6.86
May	1,450	325	716	1.30	1.50
June	4,200	220	682	1.24	1.38
July	2,080	180	421	.765	.88
August	2,310	180	588	1.07	1.23
September	8,680	490	2,110	3.84	4.28
October	1,800	325	630	1.15	1.33
November	5,520	280	696	1.27	1.42
December 1-15	12,000	760	2,240	4.07	2.27

NOTE.—Values for 1904 are rated as follows: April to June, September and October, good; remainder of year, approximate. Values for 1905 are rated as follows: January, April, September, and December, good; March, May, June, August, October, and November, fair; July, approximate.

DEERFIELD RIVER AT HOOSAC TUNNEL, MASS.

A measurement was made October 29, 1906, from the downstream side of the highway bridge at this point. The bench mark is the top of guard rail 25 feet from the downstream side of the left abutment, the distance to water surface being 23.63 feet.

Width, 125 feet; area, 130 square feet; discharge, 66 second-feet.

WARE RIVER NEAR WARE, MASS.

This station was established September 15, 1904, at the steel highway bridge about 2 miles above the village of Ware, Mass. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 136, where are given also references to publications that contain data for previous years.

Discharge measurements of Ware River near Ware, Mass., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 21 [a]	T. W. Norcross	83	159	3.40	301
April 7	do	83	230	4.17	741
October 18	F. E. Pressey	80	113	3.05	237

[a] Probably an ice jam below bridge.

Daily gage height, in feet, of Ware River near Ware, Mass., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.05	2.9	3.6	4.6	3.5	4.35	3.5	3.05	2.2	3.2	3.15	3.4
2	2.95	2.9	3.4	4.2	3.25	4.0	3.8	3.0	2.3	2.8	3.1	2.35
3	2.95	2.85	3.1	3.8	3.3	3.9	3.9	3.0	3.0	2.8	3.0	3.3
4	3.15	2.8	6.05	3.7	3.3	3.5	4.1	3.05	3.4	2.8	2.7	[e] 4.1
5	3.5	2.75	5.65	3.7	3.35	3.3	4.2	3.0	2.45	2.7	2.8	[e] 4.65
6	3.2	[a] 4.1	4.1	4.15	2.9	3.55	3.4	3.05	2.8	2.3	2.9	2.75
7	3.1	[a] 4.65	3.55	4.3	3.45	3.15	3.4	3.0	2.85	2.35	3.1	3.3
8	3.25	[a] 3.75	3.75	4.0	3.45	3.15	3.2	.....	.....	2.15	2.8	[e] 3.7
9	3.15	[b] 5.0	3.7	3.8	3.5	3.1	2.9	2.8	.....	2.9	2.8	[e] 4.65
10	[a] 3.5	[b] 5.0	3.4	4.15	3.3	3.0	2.9	.....	.....	3.2	2.6	[e] 5.2
11	[a] 3.9	(c)	3.2	4.9	3.2	3.3	2.7	2.8	.....	3.2	2.4	[e] 5.0
12	[a] 3.8	(c)	3.35	4.9	3.1	3.2	2.5	2.65	2.75	3.15	3.05	[e] 4.9
13	3.1	(c)	3.05	4.75	3.1	3.2	2.95	2.6	2.35	2.6	3.4	[e] 4.8
14	3.1	[d] 3.5	3.1	4.4	3.1	3.1	2.8	2.6	3.0	2.25	2.9	.....
15	2.95	3.7	3.05	4.3	3.0	3.1	2.65	2.7	2.7	2.5	3.0	.....
16	3.1	3.8	3.75	5.25	3.0	3.45	2.75	2.7	2.15	2.7	3.2	.....
17	3.85	[a] 3.55	3.65	4.8	2.9	3.9	2.75	2.7	2.2	2.8	3.1	3.3
18	3.55	[d] 2.9	2.75	4.25	3.1	4.1	2.6	2.35	2.6	3.0	2.5	2.7
19	3.0	3.05	3.45	4.0	3.0	4.3	2.7	1.7	2.7	3.3	3.8	3.85
20	3.0	3.95	3.0	3.85	2.8	3.95	2.5	2.7	2.7	2.9	3.75	3.9
21	2.9	[e] 2.8	3.1	3.75	2.6	3.75	3.05	2.9	3.0	3.85	3.8	3.1
22	3.4	4.4	2.95	3.5	2.6	3.55	2.6	2.9	2.6	2.6	3.7	3.05
23	3.6	4.4	2.8	3.45	2.7	3.2	2.7	3.05	2.4	2.75	3.75	3.3
24	4.1	3.7	3.1	3.5	2.6	3.3	2.6	3.2	3.15	3.2	3.0	[a] 4.4
25	3.7	3.4	2.7	3.4	2.6	3.25	2.55	2.75	2.45	3.4	2.9	[a] 5.4
26	3.5	3.9	2.65	3.2	2.9	3.1	2.25	2.3	2.8	4.0	3.25	[a] 5.2
27	3.1	3.8	2.9	3.2	2.8	3.05	2.2	2.6	2.65	3.7	3.0	4.25
28	3.3	3.5	5.1	3.05	5.6	3.05	2.25	4.4	2.5	2.8	3.1	[d] 3.65
29	3.2	.....	5.05	2.8	6.9	2.85	2.85	4.05	1.85	3.25	2.9	2.8
30	3.2	.....	4.7	3.3	6.3	2.7	3.8	3.3	2.25	3.3	3.15	[f] 2.5
31	3.05	.....	4.6	.....	4.45	.....	3.4	3.25	.....	3.15	.....	2.35

[a] Backwater due to ice jam.
[b] Water flowing over ice. Anchor ice jam below gage.
[c] River full of anchor ice.
[d] Ice going out.
[e] Ice jam about 30 feet below gage.
[f] River clear of ice.

NOTE.—River does not usually freeze at gaging section, but frequent difficulty is experienced from backwater due to a jam of anchor ice about 500 feet below.

Rating table for Ware River near Ware, Mass., for 1904–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.70	20	2.80	235	3.90	624	5.00	1,212
1.80	30	2.90	264	4.00	670	5.20	1,332
1.90	42	3.00	294	4.10	718	5.40	1,460
2.00	55	3.10	325	4.20	768	5.60	1,590
2.10	71	3.20	357	4.30	820	5.80	1,725
2.20	89	3.30	390	4.40	873	6.00	1,865
2.30	109	3.40	424	4.50	927	6.20	2,005
2.40	131	3.50	460	4.60	982	6.40	2,155
2.50	155	3.60	498	4.70	1,038	6.60	2,305
2.60	180	3.70	538	4.80	1,095	6.80	2,460
2.70	207	3.80	580	4.90	1,153	7.00	2,620

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906 and is well defined between gage heights 1.9 feet and 7 feet.

Monthly discharge of Ware River near Ware, Mass., for 1906.

[Drainage area, 162 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April	1,360	235	685	4.23	4.72
May	2,540	180	503	3.10	3.57
June	846	207	445	2.75	3.07
July	768	89	307	1.90	2.19
August	873	20	278	1.72	1.98
September	424	36	197	1.22	1.36
October	670	80	292	1.80	2.08
November	580	131	329	2.03	2.26

NOTE.—Values are rated as good.

WARE RIVER AT BARRE PLAINS, MASS.

A measurement was made October 18, 1906, from the downstream side of the wooden highway bridge at Barre Plains. The bench mark is top of top chord of bridge, 20 feet from downstream side of left abutment. The distance to water surface was 15.33 feet.

Width, 53 feet; area, 132 square feet; discharge, 104 second-feet.

QUABOAG RIVER AT WEST WARREN, MASS.

A station for securing a record of flow of Quaboag River has been maintained by the United States Geological Survey at West Warren, at the dam of J. T. F. MacDonnell, of Holyoke, since October 22, 1904. The conditions at the station and the bench marks are described in Water-Supply Paper No. 165, page 139, where are given also references to publications that contain data for previous years.

A measurement was made October 19, 1906, by wading, 150 feet below the tail race, with the following results:

Width, 125 feet; area, 120 square feet; gage height, 50.60 feet; discharge, 173 second-feet.

Daily gage height, in feet, of Quaboag River at West Warren, Mass., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	50.45	50.7	50.85	51.4	51.0	51.35	50.7	50.6	50.45	50.3	50.8	50.55
2	50.45	50.65	50.8	51.4	51.0	51.3	50.75	50.6	50.5	50.3	50.75	50.55
3	50.4	50.6	50.85	51.4	51.0	51.15	51.05	50.55	50.5	50.25	50.7	50.55
4	50.45	50.55	51.65	51.35	51.0	51.15	51.1	50.6	50.45	50.3	50.7	50.5
5	50.5	50.55	51.60	51.35	50.9	51.15	51.0	50.6	50.45	50.3	50.65	50.5
6	50.45	50.5	51.55	51.3	50.9	51.1	51.0	50.6	50.5	50.3	50.65	50.5
7	50.45	50.5	51.5	51.3	50.9	51.1	50.95	50.7	50.45	50.4	50.6	50.5
8	50.45	50.55	51.45	51.25	50.9	51.0	50.9	50.65	50.45	50.4	50.55	50.45
9	50.45	50.5	51.4	51.25	50.9	51.0	50.9	50.65	50.45	50.35	50.5	50.5
10	50.45	50.5	51.35	51.35	50.85	50.9	50.85	50.6	50.4	50.55	50.5	50.5
11	50.5	50.5	51.2	51.4	50.85	50.9	50.8	50.6	50.4	50.6	50.45	50.55
12	50.55	50.5	51.2	51.45	50.85	50.85	50.8	50.6	50.4	50.6	50.75	50.5
13	50.55	50.5	51.15	51.45	50.8	50.85	50.75	50.6	50.35	50.55	50.7	50.45
14	50.6	50.45	51.1	51.45	50.8	50.8	50.7	50.6	50.4	50.55	50.7	50.5
15	50.6	50.45	51.0	51.5	50.8	50.8	50.6	50.55	50.35	50.55	50.65	50.5
16	50.6	50.5	51.05	51.5	50.75	50.8	50.6	50.5	50.35	50.5	50.7	50.55
17	50.8	50.5	51.2	51.5	50.7	50.9	50.65	50.6	50.35	50.5	50.7	50.55
18	50.85	50.55	50.8	51.45	50.7	50.9	50.65	50.6	50.3	50.45	50.75	50.55
19	50.9	50.55	50.8	51.4	50.65	50.9	50.65	50.6	50.3	50.45	50.75	50.5
20	50.9	50.6	50.8	51.4	50.6	50.85	50.7	50.6	50.35	50.45	50.7	50.5

Daily gage height, in feet, of Quaboag River at West Warren, Mass., for 1906—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	50.95	50.65	50.75	51.35	50.6	50.85	50.75	50.55	50.3	51.1	50.6	50.5
22	51.0	51.25	50.75	51.3	50.6	50.8	50.8	50.6	50.3	51.1	50.7	50.55
23	51.0	51.2	50.75	51.3	50.55	50.75	50.8	50.55	50.45	51.05	50.7	50.55
24	51.1	51.0	50.7	51.3	50.55	50.7	50.85	50.55	50.45	51.0	50.65	50.55
25	51.0	50.95	50.7	51.25	50.5	50.65	50.8	50.5	50.4	50.95	50.65	50.5
26	50.95	50.95	50.75	51.2	50.5	50.65	50.75	50.5	50.4	50.9	50.65	50.5
27	50.9	50.9	50.75	51.2	50.5	50.6	50.7	50.5	50.35	50.9	50.6	50.5
28	50.85	50.9	51.4	51.1	51.0	50.6	50.65	50.55	50.3	50.85	50.6	50.5
29	50.85	.....	51.45	51.1	51.5	50.6	50.6	50.55	50.3	50.85	50.6	50.5
30	50.8	.....	51.45	51.1	51.5	50.6	50.6	50.5	50.25	50.8	50.6	50.5
31	50.75	.....	51.4	51.0	51.4	.....	50.65	50.5	.....	50.8	.....	51.2

NOTE.—The gage was read once a day, about 6.15 a. m. (before the mill upstream starts up) on week days and about 4 p. m. on Sundays.
The discharge is not affected by ice conditions.

Monthly discharge of Quaboag River at West Warren, Mass., for 1906.

[Drainage area, 144 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	416	89	213	1.48	1.71
February	507	106	198	1.38	1.44
March	783	205	432	3.00	3.46
April	675	416	562	3.90	4.35
May	675	123	285	1.98	2.28
June	571	161	303	2.10	2.34
July	416	161	245	1.70	1.96
August	205	123	152	1.06	1.22
September	123	41	85.1	.591	.66
October	416	41	181	1.26	1.45
November	254	106	186	1.29	1.44
December	476	106	139	.965	1.11
The year	783	41	248	1.72	23.41

QUABOAG RIVER AT PALMER, MASS.

A measurement was made October 19, 1906, from the downstream side of the highway bridge near Palmer railroad station. The bench mark is top of floor beam, 72 feet from the right abutment, downstream side of bridge. Distance to water surface, 14.25 feet.

Width, 77 feet; area, 170 square feet; discharge, 110 second-feet.

WESTFIELD LITTLE RIVER NEAR BLANDFORD, MASS.

This station was established July 13, 1905, at Cobble Mountain, near Blandford, Mass., a short distance below Borden Brook. It is maintained in cooperation with the water board of the city of Springfield, through their engineer, E. E. Lochridge. The conditions and the bench marks are described in Water-Supply Paper No. 165, page 142, where are given also references to publications that contain data for previous years.

On August 10, 1906, a sharp-crested weir, with length of crest 29.98 feet, capable of carrying a depth of flow of 1.5 feet, was installed

a short distance downstream from the current-meter station. Estimates of flow over the weir are given, based upon the coefficients given on page 36, Water-Supply Paper 150. The weir gage was read at approximately the same times as the current-meter gage.

Discharge measurements of Westfield Little River near Blandford, Mass., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 14 [a]	Barrows and Norcross	34	44	2.32	32.4
August 10 [a]	Norcross and Lochridge	32	51	2.30	23.8
September 8 [a]	do	46	73	2.98	82
September 27 [a]	T. W. Norcross	39	54	2.40	26.5
September 28 [a]	do	39	53	2.39	25.7
October 13	do	44	77	2.94	85
October 14	do	42	71	2.76	59
November 9	Norcross and Lochridge	39	59	2.57	40.1
1906.					
March 23 [b]	T. W. Norcross	40	46	2.61	38
April 5	do	65	144	4.21	449
April 6	do	69	172	4.64	594
April 6	do	69	166	4.53	587
April 6	do	68	164	4.50	565
April 6	do	69	159	4.44	555
April 23	do	50	93	3.31	162
April 24	do	50	88	3.21	135
June 22	F. E. Pressey	35	53	2.48	26.5
August 9	do	38	64	2.58	45.2
August 10	do	32	47	2.34	23.4
August 10	do	32	47	2.32	26.0
August 10	do	32	46	2.34	22.8
August 10	G. M. Brett	33	46	2.34	21.4
August 10	F. E. Pressey	32	46	2.34	22.4
August 10	G. M. Brett	33	46	2.33	24.2
August 10	Barrows and Pressey	32	44	2.83	22.3
September 18 [c]	F. E. Pressey	7.0	4.2	1.68	3.4
September 18 [c]	do	6.0	2.7	1.68	3.2
September 19 [c]	do	5.5	3.5	1.68	3.3
September 19 [c]	do	5.5	3.5	1.68	3.1
September 19 [c]	do	5.5	3.5	1.68	3.1
September 19 [c]	do	5.5	3.5	1.68	3.1
September 19 [c]	do	5.5	3.6	1.68	2.8
September 19 [c]	do	5.5	3.6	1.68	3.2
September 19 [c]	do	5.5	3.6	1.68	2.9
September 19 [c]	do	5.5	3.6	1.68	3.3
September 24 [d]	do	10	7.6	2.09	11.8
September 25 [d]	do	10	7.2	2.04	10.6
September 25 [d]	do	8	6.4	2.02	11.2
September 25 [d]	do	8	6.4	2.02	10.6
October 21	do	49	86	3.28	154
October 22	do	43	76	3.00	96
October 22	do	43	74	3.00	94
October 22	do	43	72	2.99	89
October 22	do	48	76	2.99	87.
October 22	do	43	72	2.98	88
October 22	do	43	70	2.93	81
October 22	do	43	71	2.92	77
October 23	do	42	66	2.76	63
October 23	do	42	67	2.75	61
October 23	do	41	66	2.72	56
October 23	do	41	66	2.71	56
October 23	do	40	66	2.72	59
October 24	do	38	60	2.60	43.6
October 24	do	38	57	2.59	41.3
October 24	do	38	58	2.58	40.4
October 24	do	38	57	2.56	39.8
October 24	do	38	56	2.56	39.3
October 24	do	38	57	2.58	40.8
October 25	do	48	89	3.28	150
October 25	do	48	86	3.28	138
October 25	do	48	88	3.26	140
November 23	Lee and James	45	81	3.02	93
November 24	do	43	72	2.84	72

[a] By wading; meter on a rod.
[b] River frozen over.
[c] Measured 300 feet below gage.
[d] Measured 300 feet below weir.

Daily gage height, in feet, of Westfield Little River near Blandford, Mass., for 1905–6.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.									
1					3.50	2.47	2.32	2.38	3.28
2					3.05	2.50	2.32	2.38	[a] 3.30
3					2.84	4.08	2.58	2.35	4.18
4					2.68	5.25	2.46	2.75	3.88
5					2.46	4.35	2.39	2.58	[a] 3.40
6					2.32	3.00	2.34	2.68	3.30
7					2.46	3.25	2.30	2.78	3.15
8					2.41	3.00	2.28	2.68	3.00
9					2.40	2.84	2.28	2.59	2.95
10					2.30	2.68	2.25	2.55	3.00
11					2.38	2.60	2.24	2.48	[a] 3.10
12					2.36	3.66	3.45	2.46	[a] 3.10
13				2.58	2.24	3.65	2.98	2.44	[a] 3.10
14				2.37	2.14	3.30	2.76	2.44	[a] 3.00
15				2.25	2.44	2.95	2.60	[a] 2.52	[a] 2.90
16				2.06	2.95	2.82	2.51	[a] 2.49	[a] 2.90
17				1.98	2.80	2.80	2.50	2.47	[a] 2.90
18				1.92	2.53	3.00	2.48	2.45	[a] 3.00
19				2.25	2.34	3.01	2.46	2.40	[a] 3.00
20				2.26	2.26	2.90	3.20	[a] 2.50	[a] 3.00
21				2.13	2.19	2.98	2.95	[a] 2.60	[b] 4.00
22				2.00	2.16	2.84	2.73	[a] 2.60	3.40
23				1.94	2.10	2.68	2.59	[a] 2.60	3.35
24				1.90	2.08	2.58	2.60	2.50	3.10
25				1.93	2.80	2.52	2.60	2.50	3.08
26				1.88	2.58	2.44	2.53	2.48	3.00
27				1.86	2.42	2.44	2.46	2.48	2.90
28				1.84	2.37	2.42	2.43	3.32	2.90
29				1.90	2.49	2.36	2.40	3.52	3.85
30				7.75	2.68	2.36	2.40	3.38	3.45
31				4.30	2.57		2.37		3.08
1906.									
1	3.84	2.89	2.95	3.00	2.42	1.85	2.26	2.35	2.63
2	3.45	2.84	2.77	2.66	2.32	1.80	2.18	2.31	2.42
3	3.27	2.99	2.67	2.52	2.20	1.95	2.09	2.29	2.40
4	3.27	2.91	2.57	3.01	2.30	1.98	2.04	2.21	2.46
5	3.84	2.85	2.59	2.64	2.28	1.92	1.96	2.20	2.48
6	4.48	2.83	2.97	2.45	2.20	1.85	1.92	2.18	2.73
7	3.65	2.91	2.87	2.36	2.16	1.80	1.99	2.16	2.79
8	3.38	2.84	2.75	2.28	2.84	1.78	1.95	2.12	2.90
9	3.43	3.03	2.64	2.22	2.60	1.76	2.02	2.12	3.00
10	4.41	3.16	2.74	2.24	2.36	1.75	2.82	2.08	2.78
11	5.00	3.00	2.75	2.24	2.34	1.73	2.58	2.28	2.58
12	4.43	2.89	2.53	2.19	2.24	1.79	2.46	2.50	2.52
13	3.91	2.77	2.41	2.11	2.18	1.82	2.28	2.52	2.50
14	3.73	2.66	2.30	2.06	2.08	1.78	2.12	2.47	2.54
15	5.91	2.44	2.21	2.02	2.05	1.74	2.06	2.39	2.62
16	4.89	2.28	2.49	1.98	2.02	1.70	2.04	2.37	3.30
17	3.79	2.23	2.94	2.22	1.95	1.70	2.00	2.34	3.34
18	3.57	2.17	3.08	2.38	1.96	1.68	2.08	2.70	2.88
19	3.39	2.13	3.01	2.22	1.90	1.68	2.07	3.92	2.72
20	3.33	2.15	2.81	2.15	1.86	1.79	3.72	3.54	2.82
21	3.22	2.13	2.67	2.15	2.46	2.34	3.34	3.24	[c] 3.35
22	3.13	2.10	2.55	2.10	2.20	2.42	2.96	3.24	2.88
23	3.25	2.07	2.43	2.14	2.06	2.55	2.73	3.01	2.52
24	3.26	2.10	2.55	2.18	2.15	2.14	2.60	2.86	2.65
25	3.14	2.26	2.44	2.12	2.02	2.04	2.93	2.67	2.56
26	3.06	2.21	2.36	2.00	1.98	1.98	2.92	2.64	2.50
27	2.97	2.55	2.27	2.00	1.95	2.04	2.71	2.64	2.46
28	2.89	3.47	2.20	2.30	2.26	1.99	2.62	2.64	2.42
29	2.82	4.09	2.13	2.48	2.09	2.02	2.54	2.56	2.46
30	2.97	3.48	2.12	2.95	1.99	2.38	2.44	2.60	2.51
31		3.17		2.56	1.94		2.42		3.55

[a] Anchor ice in river. [b] River clear of ice. [c] River filled with anchor ice.

NOTE.—Gage heights during freshet of July 30, 1905, estimated. Crest of flood was at gage height 8.0 feet at 8.30 a. m. Relation of gage heights to discharge changed by this flood.

Daily gage height, in feet, on weir of Westfield Little River near Blandford, Mass., for 1906.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	0.14	0.33	[a] 0.58	0.60	17	0.18	0.09	0.22	0.41	1.12
2	.....	.13	.30	[a] .56	.44	18	.18	.08	.24	.69	.86
3	.....	.18	.26	[a] .54	.42	19	.16	.08	.24	[d] 1.90	.66
4	.....	.18	.24	[a] .50	.46	20	.14	.12	[d] 1.58	1.56	.70
5	.....	.16	.20	[a] .48	.47	21	.41	.40	1.33	1.19	1.04
6	.....	.14	.18	[a] .48	.70	22	.31	.46	.90	1.15	1.02
7	.....	.13	.22	[a] .47	[c] .76	23	.23	.50	.72	.92	1.00
8	.....	.12	.20	.....	.90	24	.26	.28	.59	.76	1.12
9	.....	.11	.22	[b] .51	.98	25	.22	.23	.92	.64	1.05
10	0.36	.10	.69	[b] .47	.88	26	.18	.20	.85	.60	.99
11	.34	.09	.48	[b] .67	.94	27	.17	.26	.66	.59	.92
12	.32	.12	.40	[b] .92	1.06	28	.33	.20	.56	.60	.89
13	.25	.14	.34	[b] .96	1.00	29	.24	.22	.50	.54	.89
14	.24	.11	.31	[b] .84	.84	30	.20	.40	.46	.56	.94
15	.22	.10	.24	[b] .78	.80	31	.16	.....	.44	.....	1.40
16	.20	.09	.24	.44	1.12						

[a] Length of weir shortened to 14.8 feet.
[b] Length of weir changed to 12.5 feet.
[c] Anchor ice in river.
[d] Gage reading probably in error as flow over weir is much smaller than that for the same day by the current meter method.

Rating table for Westfield Little River near Blandford, Mass., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.65	2.4	2.45	29.9	3.25	141	4.40	535
1.70	3.1	2.50	33.8	3.30	155	4.50	570
1.75	3.9	2.55	38.1	3.35	170	4.60	605
1.80	4.8	2.60	42.8	3.40	186	4.70	640
1.85	5.8	2.65	47.8	3.45	203	4.80	675
1.90	6.9	2.70	53.1	3.50	220	4.90	710
1.95	8.0	2.75	58.7	3.55	238	5.00	745
2.00	9.2	2.80	64.7	3.60	255	5.10	780
2.05	10.6	2.85	71.1	3.65	272	5.20	815
2.10	12.2	2.90	77.9	3.70	290	5.30	850
2.15	14.0	2.95	85.0	3.80	325	5.40	885
2.20	16.0	3.00	92.4	3.90	360	5.50	920
2.25	18.2	3.05	100	4.00	395	5.60	955
2.30	20.6	3.10	109	4.10	430	5.70	990
2.35	23.3	3.15	119	4.20	465	5.80	1,025
2.40	26.4	3.20	129	4.30	500	5.90	1,060

NOTE.—The above table is applicable only for open-channel conditions. It is based on sixty-three discharge measurements made during 1905–6 and is well defined between gage heights 1.65 feet and 4.6 feet. Above gage height 3.5 feet the rating curve is a tangent, the difference being 35 per tenth.

Daily discharge, in second-feet, of Westfield Little River near Blandford, Mass., for 1905–6.

Day.	1905.				1906.				
	Aug.	Sept.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.
1	220	31.5	21.7	25.1	339	76.5	85.0	92.4	27.8
2	100	33.8	21.7	25.1	203	69.8	61.1	48.9	21.7
3	69.8	423	40.9	23.3	147	90.9	49.9	35.5	16.0
4	51.0	832	30.7	58.7	147	79.3	40.0	93.9	25.8
5	30.7	518	25.8	40.9	339	71.1	41.9	46.8	19.6
6	21.7	255	22.8	51.0	563	68.5	88.0	29.9	16.0
7	30.7	141	20.6	62.3	272	79.3	73.8	23.9	14.4
8	27.1	92.4	19.6	51.0	180	69.8	58.7	19.6	69.8
9	26.4	69.8	19.6	41.9	196	97.0	46.8	16.9	42.8
10	20.6	51.0	18.2	38.1	538	121	57.6	17.8	.....
11	25.1	42.8	17.8	32.2	745	92.4	58.7	17.8	.....
12	23.9	276	203	30.7	545	76.5	36.4	15.6	.....
13	17.8	272	89.4	29.2	364	61.1	27.1	12.6	.....
14	13.6	155	59.9	29.2	300	48.9	20.6	10.9	.....
15	29.2	85.0	42.8	[a] 35.5	1,060	29.2	16.4	9.8	.....

[a] Anchor ice in river.

Daily discharge, in second-feet, of Westfield Little River near Blandford, Mass., for 1905–6—Continued.

Day.	1905.				1906.				
	Aug.	Sept.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.
16	85.0	67.3	34.7	a33.	706	19.6	33.0	8.7	.....
17	64.7	64.7	33.8	31.5	322	17.3	83.6	16.9	.....
18	36.4	92.4	32.2	29.9	244	14.8	105	25.1	.....
19	22.8	93.9	30.7	26.4	183	13.3	93.9	16.9	.....
20	18.7	77.9	129	a33.8	164	14.0	66.0	14.0	.....
21	15.6	80.4	85.0	a42.8	134	13.3	49.9	14.0	.....
22	14.4	69.8	56.5	a42.8	115	12.2	38.1	12.2	.....
23	12.2	51.0	41.9	a42.8	141	11.2	28.5	13.6	.....
24	11.6	40.9	42.8	33.8	141	12.2	38.1	15.2	.....
25	64.7	35.5	42.8	33.8	117	18.7	29.2	12.9	.....
26	40.9	29.2	36.4	32.2	102	16.4	23.9	9.2	.....
27	27.8	29.2	30.7	32.2	88.0	38.1	19.2	9.2	.....
28	24.5	27.8	28.5	161	76.5	210	16.0	20.6	.....
29	33.0	23.9	26.4	227	67.2	426	13.3	32.2	.....
30	51.0	23.9	26.4	180	88.0	213	12.9	85.0	.....
31	39.9	.....	24.5	.....	.....	123	.....	39.0	.....

a Anchor ice in river.

Daily discharge, in second-feet, of Westfield Little River near Blandford, Mass., 1906, as determined by weir and by current-meter ratings.

Day.	Aug.			Sept.			Oct.			Nov.			Dec.
	Weir.	Current meter.	Per cent difference.	Weir.	Current meter.	Per cent difference.	Weir.	Current meter.	Per cent difference.	Weir.	Current meter.	Per cent difference.	Weir.
1	.....	.....	.....	5.42	5.8	+ 7	18.9	18.7	− 1	21.5	23.3	+ 8	46.0
2	.....	.....	.....	4.86	4.8	− 1	16.5	15.2	− 8	20.5	21.1	+ 3	29.0
3	.....	.....	.....	7.81	8.0	+ 2	13.3	11.9	−12	19.4	20.1	+ 3	27.0
4	.....	.....	.....	7.81	8.7	+11	11.9	10.3	−16	17.2	16.4	− 5	31.0
5	.....	.....	.....	6.58	7.3	+11	9.11	8.2	−11	16.3	15.6	− 4	32.0
6	.....	.....	.....	5.42	5.8	+ 7	7.81	7.3	− 7	16.3	15.2	− 7	57.8
7	.....	.....	.....	4.86	4.8	− 1	10.5	9.0	−17	15.8	14.4	−10	65.4
8	.....	.....	.....	4.33	4.4	+ 2	9.11	8.0	−14	16.1	12.9	−25	84.0
9	.....	.....	.....	3.82	4.1	+ 7	10.5	9.8	− 7	15.0	12.9	−16	95.4
10	21.5	23.9	+11	3.32	3.9	+17	56.6	67.3	+ 9	13.3	11.6	−15	81.5
11	19.8	22.8	+15	2.85	3.6	+26	33.0	40.9	+24	22.6	19.6	−15	89.6
12	18.1	17.8	− 2	4.33	4.6	+ 6	25.2	30.7	+22	36.1	33.8	− 7	107
13	12.6	15.2	+20	5.42	5.2	− 4	19.8	19.6	− 1	38.5	35.5	− 8	98.3
14	11.9	11.6	− 3	3.82	4.4	+15	17.3	12.9	−34	31.6	31.5	0	76.0
15	10.5	10.6	+ 1	3.32	3.7	+11	11.9	10.9	− 9	28.3	25.8	−10	70.5
16	9.11	9.8	+ 7	2.85	3.1	+ 8	11.9	10.3	−15	29.0	24.5	−18	116
17	7.81	8.0	+ 2	2.85	3.1	+ 8	10.5	9.2	−14	26.1	22.8	−14	116
18	7.81	8.2	+ 5	2.40	2.8	+17	11.9	11.6	− 3	56.6	53.1	− 6	78.7
19	6.58	6.9	+ 5	2.40	2.8	+17	11.9	11.2	− 6	a367	367	0	53.1
20	5.42	6.0	+11	4.33	4.6	+ 6	a297	297	0	193	234	+21	57.8
21	26.1	30.7	+17	25.2	22.8	−10	150	167	+11	128	139	+ 8	104
22	17.3	16.0	− 8	31.0	27.8	−11	84.0	86.5	+ 3	122	139	+14	101
23	11.2	10.9	− 3	35.0	38.1	+ 9	60.3	56.5	− 7	86.8	93.9	+ 8	98.3
24	13.3	14.0	+ 5	14.9	13.6	−10	44.8	42.8	− 5	65.4	72.5	+10	116
25	10.5	9.8	− 7	11.2	10.3	− 9	86.8	82.2	− 5	50.7	49.9	− 2	106
26	7.81	8.7	+11	9.11	8.7	− 5	77.4	80.7	+ 4	46.0	46.8	+ 2	96.8
27	7.20	8.0	+11	13.3	10.3	−29	53.1	54.2	+ 2	44.8	46.8	+ 4	86.8
28	18.9	18.7	− 1	9.11	9.0	− 1	41.5	44.8	+ 8	46.0	46.8	+ 2	82.8
29	11.9	11.9	0	10.5	9.8	− 7	35.0	37.3	+ 6	39.3	39.0	− 1	82.8
30	9.11	9.0	− 1	25.2	25.1	0	31.0	29.2	− 6	41.5	42.8	+ 3	89.6
31	6.58	7.8	+18	.....	.....	.....	29.0	27.8	− 4	.....	.....	.....	162
Mean	12.3	13.0	+ 5	9.1	9.0	− 1	42.2	42.9	+ 2	55.7	57.6	+ 3	.....

a Discharge over weir made same as current meter station discharge. Original maximum values for weir 198 and 290 for October and November, respectively. See gage-height table footnote.

Monthly discharge of Westfield Little River near Blandford, Mass., for 1905–6.

[Drainage area, 43 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
August	220	11.6	41.0	0.953	1.10
September	832	23.9	136	3.16	3.53
October	203	17.8	43.8	1.02	1.18
November	227	23.3	51.9	1.21	1.35
1906.					
April	1,060	67.2	288	6.70	7.48
May	426	11.2	74.3	1.73	1.99
June	105	12.9	47.1	1.10	1.23
July	93.9	8.7	27.0	.628	.72
August	69.8	6.0	17.4	.405	.47
September	38.1	2.8	9.0	.209	.23
October	297	7.3	42.9	.998	1.15
November	367	11.6	57.8	1.34	1.50

Monthly discharge (by weir) of Westfield Little River near Blandford, Mass., for 1906.

[Drainage area, 43 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
August (10–31)	26.1	5.42	12.3	0.286	0.23
September	35.0	2.40	9.1	.212	.24
October	297	7.81	42.2	.981	1.13
November	367	13.3	55.7	1.30	1.45
December	162	27.0	81.9	1.90	2.19

SALMON RIVER AT LEESVILLE, CONN.

This station was established March 28, 1905, at the plant of the East Haddam Electric Light Company at Leesville, a short distance above the bridge on the highway leading from Leesville to Easthampton. It is maintained through the cooperation of Messrs. Ransom & Hoadley, of Providence, R. I., who expect to build at this point a dam about 72 feet in height for developing light and power, which will probably be used in Hartford. The conditions at the station and the bench marks are described in Water-Supply Paper No. 165, page 144, where are given also references to publications that contain data for previous years.

Discharge measurements of Salmon River at Leesville, Conn., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 28 [a]	Barrows and Norcross	120	112	1.34	166
May 16 [a]	T. W. Norcross	122	121	1.38	177
May 26 [a]	do	98	82	.70	73
December 5 [b] [c]	do	102	400	1.97	330
1906.					
March 9 [b]	T. W. Norcross	103	408	2.25	437

[a] By wading; meter on a rod.
[b] From downstream side of highway bridge.
[c] About one-eighth of discharge estimated.

Daily gage height, in feet, of Salmon River at Leesville, Conn., for 1905–6.

Day.	1905.		1906.			Day.	1905.		1906.		
	Apr.	May.	Jan.	Feb.	Mar.		Apr.	May.	Jan.	Feb.	Mar.
1	.....	1.25	1.85	1.8	2.4	17	1.65	1.25	2.3	1.75	.....
2	.....	1.15	1.6	1.7	1.65	18	1.62	1.15	2.2	1.7	.....
3	.....	1.14	1.65	1.7	4.8	19	1.62	1.05	1.9	1.7	.....
4	.....	1.10	3.3	1.6	4.4	20	1.55	.95	2.0	1.75	.....
5	.....	1.08	2.35	1.6	3.0	21	1.52	.....	2.2	4.4	.....
6	.....	1.08	2.0	1.6	2.5	22	1.70	.....	2.1	3.3	.....
7	.....	1.04	1.95	1.7	2.35	23	1.95	.....	2.2	2.4	.....
8	.....	1.00	1.65	1.65	2.35	24	1.52	.....	2.3	2.1	.....
9	.....	.90	1.5	1.6	.....	25	1.50	.....	2.3	2.0	.....
10	.....	.90	1.65	1.7	.....	26	1.40	.....	2.0	2.0	.....
11	.....	.95	1.55	1.65	.....	27	1.40	.....	1.95	1.95	.....
12	.....	1.10	1.75	1.65	.....	28	1.35	.....	2.0	2.0	.....
13	.....	1.28	1.75	1.65	.....	29	1.29	.....	1.85	.....	.....
14	.....	1.35	1.75	1.65	.....	30	1.25	.....	1.85	.....	.....
15	.....	1.65	1.75	1.75	.....	31	.....	.....	1.8	.....	.....
16	.....	1.38	3.00	1.7	.....						

NOTE.—River did not freeze over during periods of observation, 1905 and 1906.
Gage heights for April and May, 1905, are the mean of two readings, morning and evening.
During January to March, 1906, the gage was read once a day, at midnight.

Rating table for Salmon River at Leesville, Conn., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	98	1.70	250	2.50	510	3.60	940
1.00	112	1.80	280	2.60	545	3.80	1,020
1.10	128	1.90	310	2.70	580	4.00	1,100
1.20	144	2.00	340	2.80	620	4.20	1,180
1.30	161	2.10	370	2.90	660	4.40	1,260
1.40	180	2.20	405	3.00	700	4.60	1,340
1.50	200	2.30	440	3.20	780	4.80	1,420
1.60	225	2.40	475	3.40	860		

NOTE.—The above table is applicable only for open-channel conditions. It is based on five discharge measurements made during 1905–6, and is well defined below gage height 2.2 feet. Above gage height 3 feet the rating curve is a tangent, the difference being 40 per tenth.

Monthly discharge of Salmon River at Leesville, Conn., for 1905–6.

[Drainage area, 115 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
April (17–30)	325	152	210	1.83	0.95
May (1–20)	237	98	136	1.18	.88
August (3–31)	111	72	82.9	.721	.78
September	712	85	181	1.57	1.75
October	282	64	124	1.08	1.24
November	430	97	130	1.13	1.26
December	640	149	292	2.54	2.93
1906.					
January	820	200	348	3.03	3.49
February	1,260	225	328	2.85	2.97
March (1–8)	1,420	237	690	6.00	1.79

NOTE.—Values for 1905 and 1906 are approximate. Daily discharges, August to December, 1905, are based on the averages of three gage readings per day.

ASHUELOT RIVER AT HINSDALE, N. H.

A measurement was made October 31, 1906, from the highway bridge at this point. At this time the distance from water surface to reference point was 20.66 feet, this being the top of guard railing at 50 feet from the downstream side of the left abutment.

Width, 120 feet; area, 185 square feet; discharge, 230 second-feet.

FARMINGTON RIVER AT FARMINGTON, CONN.

A measurement was made October 27, 1906, from the highway bridge, which is a short distance above the electric railway bridge near Farmington, Conn. The bench mark is the top of guard railing of bridge, 20 feet from the end of the inclined end post on the left bank, downstream side of bridge, the distance to water surface being 24.36 feet.

Width, 115 feet; area, 474 square feet; discharge, 902 second-feet.

HOUSATONIC RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Housatonic River has its source in Berkshire County, Mass. It flows southward across Massachusetts and the west end of Connecticut, entering Long Island Sound. Its course is nearly parallel to the eastern boundary of New York State, and it receives the drainage from Tenmile River in New York.

Tenmile River drains an area of diversified topography, including broad flats and marshes in the basin of Swamp River and extensive areas under cultivation and sparsely timbered hills in the region of the Chestnut Range. The drainage area lies chiefly in New York State, the stream crossing the line into Connecticut one-half mile above the junction with the Housatonic.

HOUSATONIC RIVER AT GAYLORDSVILLE, CONN.

This station was established October 24, 1900. It is located at the covered wooden highway bridge at Gaylordsville, 2 miles below the mouth of Tenmile River. The conditions are described in Water-Supply Paper No. 165, page 145, where are given also references to publications that contain data for previous years. The bench mark is a large spike in a notch on the river and highway side of a large cottonwood tree, about 150 feet from right hand end of bridge, along road to New Milford; elevation, 28.97 feet. The reference point is the top of three nails at the 1-foot mark on the gage board; elevation, 29.66 feet. Elevations refer to gage datum.

A measurement was made October 17, 1906, by C. C. Covert, with the following results:

Width, 170 feet; area, 373 square feet; gage height, 3.55 feet; discharge, 654 second-feet.

Daily gage height, in feet, of Housatonic River at Gaylordsville, Conn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.70	4.60	4.50	6.40	5.24	5.19	3.99	4.44	3.78	3.78	4.00	4.10
2	4.45	4.55	4.55	6.00	5.19	5.19	4.19	4.14	3.73	3.73	3.80	4.05
3	4.45	4.15	4.70	5.80	5.09	4.89	5.04	3.99	3.58	3.63	3.85	3.90
4	4.65	4.15	8.45	5.55	4.94	4.84	4.84	4.29	3.48	3.33	3.90	3.70
5	5.10	4.15	7.10	5.70	4.99	4.54	4.74	4.14	3.63	3.28	3.70	3.10
6	5.05	4.05	6.55	6.10	4.94	4.99	4.54	3.64	3.18	3.43	3.55	3.95
7	4.70	4.15	6.45	6.25	5.04	5.09	4.34	3.39	3.18	4.08	3.50	4.35
8	4.35	4.20	5.75	6.00	4.84	4.74	4.44	3.89	3.23	3.78	3.60	4.00
9	4.35	4.15	5.45	5.95	5.04	4.59	4.34	4.24	3.08	3.18	3.60	4.15
10	4.05	4.15	5.25	6.95	5.39	5.19	3.99	4.19	3.63	2.98	3.55	4.05
11	4.30	4.20	5.20	7.55	5.34	5.19	4.04	4.14	3.03	3.60	3.75	4.10
12	4.25	4.15	5.05	6.95	5.24	5.04	4.34	4.44	3.33	3.70	4.25	3.85
13	4.35	4.05	5.00	6.50	4.69	4.74	4.09	4.24	3.38	3.70	4.15	4.15
14	4.90	4.15	4.95	6.65	4.89	4.49	3.64	3.84	3.43	3.65	4.10	4.10
15	4.80	4.15	4.85	6.70	4.94	4.24	3.74	3.79	3.23	3.55	4.00	4.10
16	4.85	4.15	4.50	8.05	4.99	4.29	3.69	3.59	3.03	3.40	4.00	4.55
17	5.10	4.25	4.65	7.85	4.74	5.09	3.64	3.74	3.23	3.35	4.00	4.50
18	4.95	4.25	4.45	7.85	4.64	5.04	3.24	3.44	3.23	3.20	4.10	4.10
19	4.90	4.05	4.35	7.20	4.44	4.74	3.24	3.09	2.98	3.15	4.40	3.95
20	4.75	3.85	4.45	6.80	4.44	4.54	3.49	3.34	3.23	4.30	4.50	4.00
21	4.65	4.20	4.45	6.40	4.49	4.59	3.94	3.59	3.48	5.10	4.95	4.25
22	4.95	6.35	4.60	6.05	4.29	4.59	3.74	3.34	3.88	4.80	4.80	4.20
23	5.35	6.30	4.55	6.00	4.39	4.54	3.89	3.79	3.98	4.70	4.55	4.05
24	5.50	5.95	4.55	6.15	4.44	4.44	3.84	3.94	3.68	4.50	4.20	3.80
25	5.65	5.50	4.25	6.05	4.34	4.19	3.94	3.94	3.68	4.50	4.40	3.95
26	5.35	5.80	4.35	5.85	4.29	4.24	3.74	3.34	3.68	4.45	4.30	3.85
27	5.25	5.15	5.00	5.65	4.21	4.14	3.64	3.34	3.63	4.30	4.25	3.70
28	5.00	4.80	7.00	5.45	5.84	4.04	4.04	3.89	3.88	4.25	4.05	4.00
29	4.75	.....	7.00	5.25	6.54	4.14	3.79	4.04	3.73	4.00	4.00	4.00
30	4.40	.....	6.75	5.45	6.34	4.04	4.44	4.19	3.78	3.85	4.15	4.05
31	4.50	.....	6.75	.....	5.74	.....	4.44	3.99	.....	4.05	.....	4.35

NOTE.—The following ice conditions prevailed during 1906: January 8, ice along banks; February 3, ice in eddy; February 6, ice in river—anchor ice running; February 22, ice went out 9.30 a. m.; February 28, ice in eddy; March 15, ice in eddy above gorge; March 26, ice went out; December 4, ice in river.

The river seldom freezes over at gage, but jams of needle ice form on rifts below and cause backwater at times. Discharges have been computed as if open-channel conditions existed. It is believed that this will introduce little serious error.

The chain length was last checked in July, 1904, hence all gage heights may be subject to some constant error.

Rating table for Housatonic River at Gaylordsville, Conn., for 1900–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.90	266	4.10	986	5.30	2,548	7.00	6,180
3.00	303	4.20	1,082	5.40	2,714	7.20	6,700
3.10	352	4.30	1,178	5.50	2,880	7.40	7,220
3.20	402	4.40	1,274	5.60	3,076	7.60	7,740
3.30	451	4.50	1,370	5.70	3,272	7.80	8,272
3.40	501	4.60	1,506	5.80	3,468	8.00	8,800
3.50	550	4.70	1,642	5.90	3,664	8.20	9,340
3.60	618	4.80	1,778	6.00	3,860	8.40	9,880
3.70	686	4.90	1,914	6.20	4,300	8.60	10,430
3.80	754	5.00	2,050	6.40	4,740		
3.90	822	5.10	2,216	6.60	5,204		
4.00	890	5.20	2,382	6.80	5,692		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1900–1906 and is well defined between gage heights 3 feet and 5 feet.

Monthly discharge of Housatonic River at Gaylordsville, Conn., for 1906.

[Drainage area, 1,020 square miles.]

Month.	Discharge in second-feet			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq mile.	Depth in inches.
January	3,170	938	1,800	1.76	2.03
February	4,630	788	1,630	1.60	1.67
March	10,000	1,130	2,910	2.85	3.29
April	8,930	2,460	4,780	4.69	5.23
May	5,060	1,090	2,110	2.07	2.39
June	2,370	928	1,630	1.60	1.78
July	2,120	421	984	.965	1.11
August	1,310	347	818	.802	.92
September	876	296	554	.543	.61
October	2,220	296	861	.844	.97
November	1,980	550	992	.973	1.09
December	1,440	686	958	.939	1.08
The year	10,000	296	1,670	1.64	22.17

NOTE.—Values for 1906 are rated as good.

INDEX.

A. Page.

Acknowledgments and cooperation..... 22
Acre-foot, definition of..... 10
Ammonoosuc River at—
Bretton Woods, N. H.:
description..... 97
discharge..... 97
discharge, monthly..... 99
gage heights..... 97-98
rating tables..... 98
Androscoggin River at—
Dixfield, Me.:
description..... 70
discharge..... 70
discharge, monthly..... 71
gage heights..... 70-71
rating table..... 71
Rumford Falls, Me.:
dams at, plate showing..... 68
description..... 69
discharge, daily..... 69
discharge, monthly..... 70
Shelburne, N. H.:
description..... 67
discharge..... 67
discharge, monthly..... 69
gage heights..... 67-68
rating table..... 68
Androscoggin River basin:
description of..... 66
river surveys in..... 67
Aroostook River at—
Fort Fairfield, Me.:
description..... 27
discharge..... 27
discharge, monthly..... 28
gage heights..... 27-28
rating table..... 28
Ashuelot River at—
Hinsdale, N. H.:
description..... 112
discharge..... 112
Atlantic coast of New England drainage.. 22-114

B.

Barre Plains, Mass.,
Ware River at:
description..... 104
discharge..... 104
Barrows, H. K., work in charge of..... 7
Bingham, Me.,
Kennebec River at:
description..... 57
discharge..... 57
Blackstone River near—
Woonsocket, R. I.:
description..... 88
Blackstone River basin: Page.
description of..... 88
Blandford, Mass.,
Westfield Little River near:
description..... 105-106
discharge..... 106
discharge, daily..... 108-109
discharge, monthly..... 110
gage heights..... 107-108
rating table..... 108
Bolster, R. H., work of..... 7
Brett, G. M., work of..... 7
Bretton Woods, N. H.,
Ammonoosuc River at:
description..... 97
discharge..... 97
discharge, monthly..... 99
gage heights..... 97-98
rating tables..... 98
Butterfield, A. D., work of..... 7

C.

Cable station, figure showing..... 17
Carrabassett River at—
North Anson, Me.:
description..... 62
discharge..... 62
discharge, monthly..... 63
gage heights..... 62
rating table..... 63
Center Conway, N. H.,
Saco River near:
description..... 71
discharge..... 71
discharge, monthly..... 72
gage heights..... 71-72
rating table..... 72
Clinton, Mass.,
Nashua River (South Branch) at:
description..... 87
rainfall..... 88
yield..... 88
Cobbosseecontee Stream at—
Gardiner, Me.:
description..... 64-65
discharge, daily..... 65-66
discharge, monthly..... 66
Cochituate, Mass.,
Lake Cochituate at:
description..... 86
rainfall..... 86-87
yield..... 86-87
Cold Stream at—
Enfield, Me.:
description..... 42
discharge..... 43
discharge, monthly..... 44

Cold Stream at— Page.
Enfield, Me.—Continued.
gage heights 43
rating table 44
Computation, methods of 19–22
Connecticut River at and near—
Hartford, Conn.:
description 98
gage heights 93
Orford, N. H.:
description 89
discharge 89
discharge, monthly 91
gage heights 89–90
rating tables 90
Sunderland, Mass.:
description 91
discharge 91
discharge, monthly 93
gage heights 91–92
rating table 92
Connecticut River basin:
description of 88–89
Contoocook River at—
West Hopkinton, N. H.:
description 84
discharge 84
discharge, monthly 85
gage heights 84–85
rating table 85
Cooperation and acknowledgments 22
Current-meter station, view of 16
Current meters, classes of 16
methods of using 16–18
plate showing 16
Curves (discharge, area, and velocity), figure showing 17

D.

Dead River near—
The Forks, Me.:
description 60
discharge 60
discharge, monthly 62
gage heights 60–61
rating table 61
Dedham, Me.,
Phillips Lake in:
description 45
discharge 45
discharge, monthly 47–48
gage heights 46
rating tables 47
Deerfield River at—
Deerfield, Mass.:
description 101
discharge 101
discharge, monthly 102
rating table 101
Hoosac Tunnel, Mass.:
description 102
discharge 102
Definitions of terms used 9–10
Discharge, methods of measuring and computing 19–22
Dixfield, Me.,
Androscoggin River at:
description 70
discharge 70
Dixfield, Me.—Continued. Page.
Androscoggin River at:
discharge, monthly 71
gage heights 70–71
rating table 71
Drainage basins, list of 8–9

E.

East Branch Penobscot River. *See* Penobscot River (East Branch).
East Holden, Me.,
Phillips Lake near:
discharge, monthly 47–48
Phillips Lake (northern outlet) at:
description 44–45
discharge 45
gage heights 46
rating table 47
Enfield, Me.,
Cold Stream at:
description 42
discharge 43
discharge, monthly 44
gage heights 43
rating table 44
Equivalents, table of 12–13

F.

Farmington River at—
Farmington, Conn.:
description 112
discharge 112
Fish River at—
Wallagrass, Me.:
description 25
discharge 25
discharge, monthly 27
gage heights 25–26
rating tables 26
Floats, use of, in measuring discharge 15–16
Follansbee, Robert, work of 7
Forks. *See* The Forks.
Fort Fairfield, Me.,
Aroostook River at:
description 27
discharge 27
discharge, monthly 28
gage heights 27–28
rating table 28
Fort Kent, Me.,
St. John River at:
description 23
discharge 23
discharge, monthly 25
gage heights 24
rating table 24
Foxcroft, Me.,
Piscataquis River near:
description 41
discharge 41
discharge, monthly 42
gage heights 41–42
rating table 42
Framingham, Mass.,
Sudbury River at:
description 86
rainfall 86–87
yield 86–87

Page.
Franklin Junction, N. H.,
Merrimac River at:
description 76
discharge 76
discharge, monthly 78
gage heights 77
rating table 77

G.

Gaging stations, equipment of 15
location of, map showing 8
Gallons per minute, definition of 10
Gardiner, Me.,
Cobbosseecontee Stream at:
description 64-65
discharge, daily 65-66
discharge, monthly 66
Garvins Falls, N. H.,
Merrimac River at:
description 78
discharge 79
discharge, daily 79
discharge, monthly 79
Gaylordsville, Conn.,
Housatonic River at:
description 113
discharge 113
discharge, monthly 114
gage heights 113
rating table 113
Great Falls of Saco River, view of 74
Grindstone, Me.,
Penobscot River (East Branch) at:
description 38
discharge 38
discharge, monthly 39
gage heights 38
rating table 39

H.

Hartford, Conn.,
Connecticut River at:
description 98
gage heights 98
Henshaw, F. F., work of 7
Hinsdale, N. H.,
Ashuelot River at:
description 112
discharge 112
Hiram, Me., falls at, view of 74
Holden, Me.,
Phillips Lake in:
description 44-45
discharge 45
discharge, monthly 47-48
gage heights 46
rating tables 47
Hoosac Tunnel, Mass.,
Deerfield River at:
description 102
discharge 102
Horsepower, calculation of 11
Housatonic River at—
Gaylordsville, Conn.:
description 112
discharge 113
discharge, monthly 114
gage heights 113
rating table 113

Page.
Housatonic River basin:
description of 112
Hoyt, J. C., work in charge of 7
Hydrographic surveys, organization and scope of 8

I.

Ice-covered streams, flow of, measurement of 19
Israel River (above South Branch) near—
Jefferson Highlands, N. H.:
description 94
discharge 94
discharge, monthly 95
gage heights 94
rating table 94
Israel River (below South Branch) near—
Jefferson Highlands, N. H.:
description 95
discharge 95
discharge, monthly 96
gage heights 95-96
rating table 96

J.

Jefferson Highlands, N. H.,
Israel River (above South Branch) near:
description 94
discharge 94
discharge, monthly 95
gage heights 94
rating table 94
Israel River (below South Branch) near:
description 95
discharge 95
discharge, monthly 96
gage heights 95-96
rating table 96

K.

Kennebec River at and near—
Bingham, Me.:
description 57
discharge 57
North Anson, Me.:
description 52-53
discharge 53
discharge, monthly 55
gage heights 53-54
rating tables 54-55
The Forks, Me.:
description 51
discharge 51
discharge, monthly 52
gage heights 51-52
rating table 52
Waterville, Me.:
description 55-56
discharge, daily 56-57
discharge, monthly 57
Kennebec River basin:
description of 48-49
river surveys in 49

L.

Lawrence, Mass.,
Merrimac River at:
description 80
discharge, daily 80
weekly flow 81

Page.
Leesville, Conn.,
Salmon River at:
description 110
discharge 110
discharge, monthly 111
gage heights 111
rating table 111
Los Angeles, Cal., current-meter station at, view of 16

M.

Machias River near—
Whitneyville, Me.:
description 32
discharge 32
gage heights 34
Machias River basin:
description of 32
Madison, Me.,
Sandy River near:
description 63
discharge, daily 63-64
discharge, monthly 64
Mattawamkeag River at—
Mattawamkeag, Me.:
description 39
discharge 39
discharge, monthly 41
gage heights 39-40
rating table 40
Mention, R. A., work of 7
Merrimac River at—
Franklin Junction, N. H.:
description 76
discharge 76
discharge, monthly 78
gage heights 77
rating table 77
Garvins Falls, N. H.:
description 78
discharge 78
discharge, daily 79
discharge, monthly 79
Lawrence, Mass.:
description 80
discharge, daily 80
weekly flow 81
Merrimac River basin:
description of 76
Millinocket, Me.,
Penobscot River at:
description 34
discharge, daily 34
discharge, monthly 34
Miner's inch, definition of 10
Moose River, survey on 49
Moose River at and near—
Rockwood, Me.:
description 57
discharge 58
discharge, monthly 59
gage heights 58
rating table 58
Moosehead Lake at—
East Outlet, Me.:
description 49
gage heights 50

Page.
Multiple-point method of measuring discharge, description of 17-18

N.

Nashua River (South Branch) at—
Clinton, Mass.:
description 87
rainfall 88
yield 88
Norcross, T. W., work of 7
North Anson, Me.,
Carrabassett River at:
description 62
discharge 62
discharge, monthly 63
gage heights 62
rating table 63
Kennebec River near:
description 52-53
discharge 53
discharge, monthly 55
gage heights 53-54
rating table 54-55

O.

Orford, N. H.,
Connecticut River near:
description 89
discharge 89
discharge, monthly 91
gage heights 89-90
rating table 90

P.

Padgett, H. D., work of 7
Palmer, Mass.,
Quaboag River at:
description 105
discharge 105
Pemigewasset River at—
Plymouth, N. H.:
description 82
discharge 82
discharge, monthly 84
gage heights 82-83
rating table 83
Penobscot River at—
Millinocket, Me.:
description 34
discharge, daily 34
discharge, monthly 34
West Enfield, Me.:
description 35-36
discharge 36
discharge, monthly 37
gage heights 36-37
rating table 37
Penobscot River (East Branch) at—
Grindstone, Me.:
description 38
discharge 38
discharge, monthly 39
gage heights 38
rating table 39
Penobscot River basin:
description of 34
river surveys in 34

Page.
Phillips Lake in—
Holden and Dedham, Me.:
description 44-45
discharge 45
discharge, monthly 47-48
gage heights 46
rating tables 47
Piscataquis River near—
Foxcroft, Me.:
description 41
discharge 41
discharge, monthly 42
gage heights 41-42
rating table 42
Plymouth, N. H.,
Pemigewasset River at:
description 82
discharge 82
discharge, monthly 84
gage heights 82, 83
rating table 83
Power plants, views of 28-68
Pressey, F. E., work of 7
Presumpscot River at—
Sebago Lake, Me.:
description 72
discharge, daily 73
discharge, monthly 73
Presumpscot River basin:
description 72
Price current meter, view of 16

Q.

Quaboag River at—
Palmer, Mass.:
description 105
discharge 105
West Warren, Mass.:
description 104
discharge, monthly 105
gage heights 104-105

R.

Rating tables, construction of 19, 21
Roach River at—
Roach River, Me.:
description 59
discharge, monthly 60
gage heights 59
rating table 60
Rockwood, Me.,
Moose River, near:
description 57
discharge 58
discharge, monthly 59
gage heights 58
rating table 58
Rumford Falls, Me.,
Androscoggin River at:
dams on, views of 68
description 69
discharge, daily 69
discharge, monthly 70
Run-off, office methods of computing 19-22
Run-off in inches, definition of 10

S.

Saco River, falls on, view of 74
view on 28
Saco River near—
Center Conway, N. H.:
description 71
discharge 71
discharge, monthly 72
gage heights 71-72
rating table 72
Saco River basin:
description of 71
St. Croix Paper Company, plant of, view of. 28
St. Croix River near—
Woodland, Me.:
description 29
discharge 30
discharge, monthly 31
gage heights 30-31
rating table 31
St. Croix River basin:
description of 29
St. John River at—
Fort Kent, Me.:
description 23
discharge 23
discharge, monthly 25
gage heights 24
rating table 24
St. John River basin:
description of 22-23
Salmon Falls, view below 28
Salmon River at—
Leesville, Conn.:
description 110
discharge 110
discharge, daily 111
gage heights 111
rating table 111
Sandy River near—
Madison, Me.:
description 63
discharge, daily 63-64
discharge, monthly 64
Sebago Lake, Me.,
Presumpscot River at:
description 72
discharge, daily 73
discharge, monthly 73
Second-feet per square mile, definition of.. 10
Second-foot, definition of 10
Shelburne, N. H.,
Androscoggin River at:
description 67
discharge 67
discharge, monthly 69
gage heights 67-68
rating table 68
Single-point method of measuring discharge, description of 18
Slope method of measuring discharge, use and value of 13-14
South Branch Nashua River. *See* Nashua River (South Branch).
Spragues Falls, Me., power plant at, view of 28
Stewart, J. E., work of 7
Stream flow, measurement and computation of 13-22
papers on, list of 9

Page.

Sudbury River at—
Framingham, Mass.:
description 86
rainfall 86–87
yield 86–87
Sunderland, Mass.,
Connecticut River at:
description 91
discharge 91
discharge, monthly 93
gage heights 91–92
rating table 92

T.

Tables, explanation of 10–12
The Forks, Me.,
Dead River near:
description 60
discharge 60
discharge, monthly 62
gage heights 60–61
rating table 61
Kennebec River at:
description 51
discharge 51
discharge, monthly 52
gage heights 51–52
rating table 52
Twin Mountain, N. H.,
Zealand River near:
description 99
discharge 99
discharge, monthly 100
gage heights 100
rating table 100

V.

Velocity method of measuring discharge, description of 15–19
Vertical-integration method of measuring discharge, description of 18
Vertical velocity-curve method of measuring discharge, description of 17

W.

Wallagrass, Me.,
Fish River at:
description 25
discharge 25
discharge, monthly 27
gage heights 25–26
rating tables 26
Ware River at—
Barre Plains, Mass.:
description 104
discharge 104
Ware River near—
Ware, Mass.:
description 102
discharge 102
discharge, monthly 104

Page.

Ware River near—
Ware, Mass.—Continued.
gage heights 103
rating table 103
Waterville, Me.,
Kennebec River at:
description 55–56
discharge, daily 56–57
discharge, monthly 57
Weir method of measuring discharge, description of 14–15
West Enfield, Me.,
Penobscot River at:
description 35–36
discharge 36
discharge, monthly 37
gage heights 36–37
rating table 37
West Hopkinton, N. H.,
Contoocook River at:
description 84
discharge 84
discharge, monthly 85
gage heights 84–85
rating table 85
West Warren, Mass.,
Quaboag River at:
description 104
discharge, monthly 104–105
gage heights 105
Westfield, Little River near—
Blandford, Mass.:
description 105–106
discharge 106
discharge, daily 108–109
discharge, monthly 110
gage heights 107–108
rating table 108
Whitneyville, Me.,
Machias River near:
description 32
discharge 32
gage heights 34
Woodland, Me.,
St. Croix River near:
description 29
discharge 30
discharge, monthly 31
gage heights 30–31
rating table 31
Woonsocket, R. I.,
Blackstone River near:
description 88

Z.

Zealand River near—
Twin Mountain, N. H.:
description 99
discharge 99
discharge, monthly 100
gage heights 100
rating table 100

CLASSIFICATION OF THE PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

[Water-Supply Paper No. 201.]

The publications of the United States Geological Survey consist of (1) Annual Reports; (2) Monographs; (3) Professional Papers; (4) Bulletins; (5) Mineral Resources; (6) Water-Supply and Irrigation Papers; (7) Topographic Atlas of United States, folios and separate sheets thereof; (8) Geologic Atlas of United States, folios thereof. The classes numbered 2, 7, and 8 are sold at cost of publication; the others are distributed free. A circular giving complete lists can be had on application.

Most of the above publications can be obtained or consulted in the following ways:

1. A limited number are delivered to the Director of the Survey, from whom they can be obtained, free of charge (except classes 2, 7, and 8), on application.

2. A certain number are delivered to Senators and Representatives in Congress, for distribution.

3. Other copies are deposited with the Superintendent of Documents, Washington, D. C., from whom they can be had at practically cost.

4. Copies of all Government publications are furnished to the principal public libraries in the large cities throughout the United States, where they can be consulted by those interested.

The Professional Papers, Bulletins, and Water-Supply Papers treat of a variety of subjects, and the total number issued is large. They have therefore been classified into the following series: A, Economic geology; B, Descriptive geology; C, Systematic geology and paleontology; D, Petrography and mineralogy; E, Chemistry and physics; F, Geography; G, Miscellaneous; H, Forestry; I, Irrigation; J, Water storage; K, Pumping water; L, Quality of water; M, General hydrographic investigations; N, Water power; O, Underground waters; P, Hydrographic progress reports.

Series P.—The hydrographic progress reports contain the results of stream measurements. A report is issued for every calendar year, containing the results of data collected during that year. These reports were first published as a part of the Director's annual report or as a bulletin; they are now published as water-supply and irrigation papers. The following is a list, by years, of the publications containing the progress reports of stream measurements (* means out of stock). A detailed index of these reports (1888–1903) is published as Water-Supply Paper No. 119.

1888. Tenth Annual Report, Part II*.
1889. Eleventh Annual Report, Part II*.
1890. Twelfth Annual Report, Part II*.
1891. Thirteenth Annual Report, Part III*.
1892. Fourteenth Annual Report, Part II*.
1893. Bulletin No. 131*.
1894. Bulletin No. 131*; Sixteenth Annual Report, Part II*.
1895. Bulletin No. 140*.
1896. Water-Supply Paper No. 11*; Eighteenth Annual Report, Part IV*.
1897. Water-Supply Papers Nos. 15* and 16*; Nineteenth Annual Report, Part IV*.
1898. Water-Supply Papers Nos. 27* and 28*; Twentieth Annual Report, Part IV*.
1899. Water-Supply Papers Nos. 35*, 36*, 37*, 38*, and 39*; Twenty-first Annual Report, Part IV*.
1900. Water-Supply Papers Nos. 47, 48, 49, 50, 51, and 52; Twenty-second Annual Report, Part IV.
1901. East of Mississippi River, Water-Supply Papers Nos. 65* and 75*.
West of Mississippi River, Water-Supply Papers Nos. 66 and 75*.

Water-Supply and Irrigation Paper No. 202 Series P, Hydrographic Progress Reports, 56

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

SURFACE WATER SUPPLY
OF
HUDSON, PASSAIC, RARITAN, AND DELAWARE RIVER DRAINAGES

1906

H. K. BARROWS AND N. C. GROVER
DISTRICT HYDROGRAPHERS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1907

CONTENTS.

	Page.
Introduction	1
Scope of work	1
Definitions	4
Explanation and use of tables	4
Convenient equivalents	6
Field methods of measuring stream flow	7
Office methods of computing run-off	13
Cooperation and acknowledgments	16
Hudson River drainage basin	16
Description of basin	16
Hudson River at Fort Edward, N. Y	19
Hudson River at Mechanicsville, N. Y	20
Indian Lake Reservoir at Indian Lake, N. Y	21
Hoosic River at Buskirk, N. Y	21
Mohawk River at Little Falls, N. Y	23
Mohawk River at Dunsbach Ferry Bridge, N. Y	24
Oriskany Creek at Coleman, N. Y	25
Starch Factory Creek near New Hartford, N. Y	26
Sylvan Glen Creek near New Hartford, N. Y	27
Graefenberg Creek near New Hartford, N. Y	28
West Canada Creek at Twin Rock Bridge, N. Y	29
West Canada Creek at East Bridge, N. Y	30
East Canada Creek at Dolgeville, N. Y	31
Schoharie Creek at Prattsville, N. Y	32
Kinderhook Creek at Bossman, N. Y	34
Catskill Creek at South Cairo, N. Y	36
Esopus Creek at Kingston, N. Y	36
Esopus Creek near Olive Bridge, N. Y	38
Wappinger Creek near Wappinger Falls, N. Y	40
Delaware and Hudson Canal at Creeklocks, N. Y	41
Rondout Creek at Rosendale, N. Y	42
Miscellaneous measurements	44
Passaic River drainage basin	45
Description of basin	45
Passaic River at Millington, N. J	45
Passaic River near Chatham, N. J	48
Rampo River near Mahwah, N. J	49
Raritan River drainage basin	51
Description of basin	51
South Branch Raritan River at Stanton, N. J	52
North Branch Raritan River near Plukemin, N. J	53
Raritan River at Finderne, N. J	56
Raritan River at Boundbrook, N. J	57

	Page.
Delaware River drainage basin	59
Description of basin	59
West Branch Delaware River at Hancock, N. Y	60
East Branch Delaware River at Hancock, N. Y	61
Delaware River at Riegelsville, N. J	63
Delaware River at Lambertville, N. J	64
Musconetcong River near Bloomsbury, N. J	64
Tohickon Creek at Point Pleasant, Pa	66
Neshaminy Creek at forks, Pennsylvania	67
Schuylkill Creek near Philadelphia, Pa	68
Perkiomen Creek at Frederick, Pa	69
Wissahickon Creek near Philadelphia, Pa	70
Index	73

ILLUSTRATIONS.

		Page.
PLATE I.	Map of United States showing location of principal river stations maintained during 1906	1
II.	*A*, Current-meter rating station, Los Angeles, Cal.; *B*, Price current meters	10
FIG. 1.	Cable station showing section of river, car, gage, etc	11
2.	Discharge, area, and mean-velocity curves for Potomac River at Point of Rocks, Md	15

SAIC, RARITAN, AND
906."

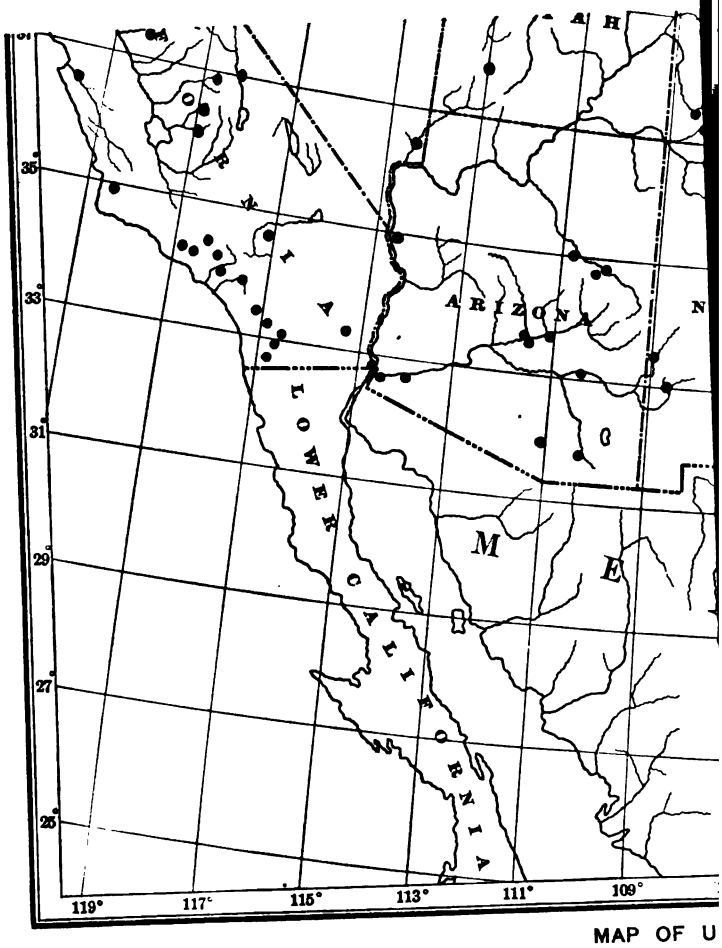
ER,

nportance to the
atural resource.
it is determined
in all parts of
d towns makes
industrial uses,
of the water
n of manufac-
facilities and
made in the
ion of water
s, railroads,
me distance

erprises or
thorough
ing of the
based on
the flow
be pro-
to year,

of the year.
stance was
carried on

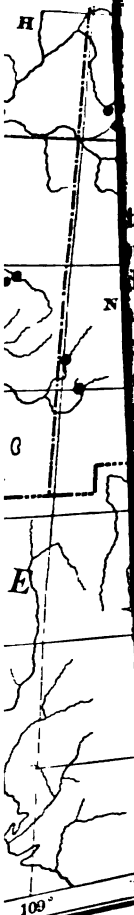
of John C.


35°
33°
31°
29°
27°
25°
119°
117°
115°
113°
111°
109°
ARIZONA
LOWER CALIFORNIA
M
E

MAP OF U

WATER SUPPLY OF THE HUDSON, PASSAIC, RARITAN, AND DELAWARE RIVER DRAINAGES, 1906.[a]

H. K. Barrows and N. C. Grover,
District Hydrographers.[b]



INTRODUCTION.

SCOPE OF WORK.

ter supply of the United States is of more importance to the ursuits of the people than is any other natural resource. d States the limit of agricultural development is determined ount of water available for irrigation; while in all parts of y the increase in the population of cities and towns makes additional water supplies for domestic and industrial uses, ng which both the quantity and the quality of the water be obtained must be considered. The location of manufac- nts may depend largely on the water-power facilities and racter of the water. The notable advances made in the nsmission of power have led to the utilization of water the operation of manufacturing establishments, railroads, ipal lighting plants, many of which are at some distance laces at which the power is developed.

lligent establishment and maintenance of enterprises or that depend on the use of water demand a thorough of the flow of the streams and an understanding of the affecting that flow. This knowledge should be based on ng both the total flow and the distribution of the flow the year, in order that normal fluctuations may be pro- As the flow of a stream is variable from year to year,

[a] New York was under the direction of Mr. R. E. Horton for the first half of the year. alf of the year it was under the direction of Mr. H. K. Barrows, and assistance was out the year by C. C. Covert. The work outside of New York State was carried on n of Mr. N. C. Grover, assisted by members of the computing section.

[b] were made and the data prepared for publication under the direction of John C. R. H. Bolster, F. F. Henshaw, Robert Follansbee, and H. D. Padgett.

estimates of future flow can be made only from a study of observations covering several years. The rapid increase in the development of the water resources of the United States has caused a great demand by engineers for information in regard to the flow of streams, as it is now generally realized that the failure of many large power, irrigation, and other projects has been due to the fact that the plans were made without sufficient trustworthy information in respect to the water supply.

Owing to the broad scope of these hydrographic investigations and the length of time they should cover in order that the records may be of greatest value, it is in general impossible for private individuals to collect the necessary data, and as many of the streams traverse more than one State this work does not properly fall within the province of the State authorities. The United States Geological Survey has therefore, by means of specific appropriations by Congress, for several years systematically made records of stream flow, with the view of ultimately determining all the important features governing the flow of the principal streams of the country. In carrying out this plan stations are established on the streams and maintained for a period long enough to show their regimen or general behavior. When a record that is sufficient for this purpose has been obtained for any stream the work on that stream is discontinued. The order in which the streams are measured is determined by the degree of their importance.

During 1906 the regimen of flow was studied at about 700 stations distributed along the various rivers throughout the United States, as shown on Pl. I. In addition to these records data in regard to precipitation, evaporation, water power, and river profiles were obtained in many sections of the country.

These data have been assembled by drainage areas, and are published in a series of fourteen Water-Supply and Irrigation Papers, Nos. 201 to 214, inclusive, each of which pertains to the surface water resources of a group of adjacent areas. In these papers are embodied not only the data collected in the field, but also the results of computations based on these data, and other information that has a direct bearing on the subject, such as descriptions of basins and the streams draining them, utility of the water resources, etc. The list follows:

Water-Supply and Irrigation Papers on Surface Water Supply, 1906.

201. Surface water supply of New England, 1906 (Atlantic coast of New England drainage).
202. Surface water supply of the Hudson, Passaic, Raritan, and Delaware river drainages, 1906.

203. Surface water supply of the Middle Atlantic States, 1906. (Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages.)
204. Surface water supply of the Southern Atlantic and Eastern Gulf States, 1906. (Santee, Savannah, Ogeechee, and Altamaha rivers and eastern Gulf of Mexico drainages.)
205. Surface water supply of the Ohio and lower eastern Mississippi river drainages, 1906.
206. Surface water supply of the Great Lakes and St. Lawrence River drainages, 1906.
207. Surface water supply of the upper Mississippi River and Hudson Bay drainages, 1906.
208. Surface water supply of the Missouri River drainage, 1906.
209. Surface water supply of the lower western Mississippi River drainage, 1906.
210. Surface water supply of the western Gulf of Mexico and Rio Grande drainages, 1906.
211. Surface water supply of the Colorado River drainage above Yuma, 1906.
212. Surface water supply of the Great Basin drainage, 1906.
213. Surface water supply of California, 1906. (The Great Basin and Pacific Ocean drainages in California, and Colorado River drainage below Yuma.)
214. Surface water supply of the North Pacific Coast drainage, 1906.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing such records up to and including 1903 has been published in Water-Supply Paper No. 119. The following table gives, by years and primary drainage basins, the numbers of the papers on surface water supply published from 1901 to 1906:

Numbers of Water-Supply Papers containing results of stream measurements, 1901-1906.[a]

	1901.	1902.	1903.	1904.	1905.	1906.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
Atlantic coast of New England drainage	65 75	82	97	124	165	201
Hudson, Passaic, Raritan, and Delaware river drainages	65 75	82	97	125	166	202
Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages	65 75	82 83	97 98	126	167	203
Santee, Savannah, Ogeechee, and Altamaha rivers, and eastern Gulf of Mexico drainages	65 75	83	98	127	168	204
Ohio and lower eastern Mississippi river drainages	65 75	83	98	128	169	205
Great Lakes and St. Lawrence River drainages	65	83	97	129	170	206
Hudson Bay and upper eastern and western Mississippi River drainages	65 66 75	83 84 85	98 99 100	128 130	171	207
Missouri River drainage	66 75	84	99	130 131	172	208
Meramec, Arkansas, Red, and lower western Mississippi river drainages	66 75	84	99	131	173	209
Western Gulf of Mexico and Rio Grande drainages	66 75	84	99	132	174	210
Colorado River drainage above Yuma	66 75	85	100	133	175	211
The Great Basin drainage	66 75	85	100	133	176	212
The Great Basin and Pacific Ocean drainages in California, and Colorado River drainage below Yuma	66 75	85	100	134	177	213
North Pacific Coast drainage	66 75	85	100	135	178	214

[a] Reports containing data for years prior to 1901 are noted in the series list at the end of this paper.

DEFINITIONS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet per square mile, and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second, and is the quantity of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the quantity of water that passes through an orifice 1 inch square under a head which varies locally. It has been commonly used by miners and irrigators throughout the West, and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

"Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work. There is a convenient relation between the second-foot and the acre-foot: One second-foot flowing for twenty-four hours will deliver 86,400 cubic feet, or approximately 2 acre-feet.

EXPLANATION AND USE OF TABLES.

For each regular gaging station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of monthly and yearly discharges and run-off.

6. Tables showing discharge and horsepower and the number of days during the year when the same are available.

The descriptions of stations give such general information about the locality and equipment as would enable the reader to find and use the station, and they also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, the name of the hydrographer, the width and area of cross section, the gage height, and the discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. At most stations the gage is read in the morning and in the evening.

The discharge measurements and gage heights are the base data from which the other tables are computed. In cases of extensive development it is expected that engineers will use these original data in making their calculations, as the computations made by the Survey are based on the data available at the time they are made and should be reviewed and, if necessary, revised when additional data are available.

The rating table gives the discharge in second-feet corresponding to various stages of the river as given by the gage heights. It is published to enable engineers to determine the daily discharge in case this information is desired.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow for each second during the month. Upon this the computations for the remaining columns, which are defined on page 4, are based.

The values in the table of monthly discharge are intended to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates.

In most work where data in regard to flow are used the regimen of flow is of primary importance. Therefore for the principal stations tables have been prepared showing the horsepower that can be

developed at various rates of flow, and the length of time that these rates of flow and the corresponding horsepower are available. These tables have been prepared on a basis of 80 per cent efficiency on the turbines, and the horsepower per foot of fall is given in order that the reader can determine the horsepower for any fall.

In the computations, sufficient significant figures have been used so that the percentage of error in the tables will not in general exceed 1 per cent. Therefore, most of the values in the tables are given to only three significant figures. In making the various computations, Thatcher's slide rule, Crelle's tables, and computation machines have been generally used.

In order to give engineers an idea of the relative value of the various data, notes in regard to accuracy are given as far as possible. This accuracy depends on the general local conditions at the gaging stations and the amount of data collected. Every effort possible is made to so locate the stations that the data collected will give a high degree of accuracy. This is not always possible, but it is considered better to publish rough values with explanatory notes rather than no data.

In the accuracy notes the following terms have been used, indicating the probable accuracy, in per cent, of the mean monthly flow. As these values are mean values, the error in the value for the flow of any individual day may be much larger.

Excellent indicates that the mean monthly flow is probably accurate to within 5 per cent; good, to within 10 per cent; fair, to within 15 per cent; approximate, to within 25 per cent.

CONVENIENT EQUIVALENTS.

Following is a table of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).

1 second-foot equals 38.4 Colorado miner's inches.

1 second-foot equals 40 Arizona miner's inches.

1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.

1 second-foot equals 6.23 British imperial gallons per second.

1 second-foot for one year covers 1 square mile 1.131 feet, or 13.572 inches deep.

1 second-foot for one year equals 31,536,000 cubic feet.

1 second-foot equals about 1 acre-inch per hour.

1 second-foot for one day covers 1 square mile 0.03719 inch deep.

1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.

1 second-foot for one 29-day month covers 1 square mile 1.079 inches deep.

1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.

1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.

1 second-foot for one day equals 1.983 acre-feet.

1 second-foot for one 28-day month equals 55.54 acre-feet.

1 second-foot for one 29-day month equals 57.52 acre-feet.

1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equal 15.7 United States gallons per second.
100 California miner's inches equal 96.0 Colorado miner's inches.
100 California miner's inches for one day equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 104 California miner's inches.
100 Colorado miner's inches for one day equal 5.17 acre-feet.
100 United States gallons per minute equal 0.223 second-foot.
100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1¼ horsepower equal about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water-wheel, realizing 80 per cent of theoretical power.

FIELD METHODS OF MEASURING STREAM FLOW.

The methods used in collecting these data and in preparing them for publication are given in detail in Water-Supply Papers No. 94 (Hydrographic Manual, U. S. Geological Survey) and No. 95 (Accuracy of Stream Measurements). In order that those who use this report may readily become acquainted with the general methods employed, the following brief descriptions are given:

Streams may be divided, with respect to their physical conditions, into three classes: (1) Those with permanent beds; (2) those with beds which change only during extreme low or high water; (3) those with constantly shifting beds. In determining the daily flow, special methods are necessary for each class. The data upon which these

determinations are based and the method of collecting them are, however, in general the same.

There are three distinct methods of determining the flow of open-channel streams: (1) By measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir; (3) by measurements of the velocity of the current and the area of the cross section. The method chosen for any case depends upon the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to the coefficients to be used in the Chezy formula, $v=c\sqrt{Rs}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The results obtained by the slope method are, in general, only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for n to be used in Kutter's formula. The most common use of this method is in estimating the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions.

Weir method.—When funds are available and the conditions are such that sharp-crested weirs can be erected, these offer the best facilities for determining the flow. If dams are suitably situated and constructed, they may be utilized for obtaining reliable measurements of flow. The conditions necessary to insure good results may be divided into two classes—(1) those relating to the physical characteristics of the dam itself, and (2) those relating to the diversion and use of water around and through the dam.

The physical requirements are as follows: (*a*) Sufficient height of dam, so that backwater will not interfere with free fall over it; (*b*) absence of leaks of appreciable magnitude; (*c*) topography or abutments which confine the flow over the dam at high stages; (*d*) level crests which are kept free from obstructions caused by floating logs or ice; (*e*) crests of a type for which the coefficients to be used in $Q=c\,b\,h^{\frac{3}{2}}$, or some similar standard weir formula, are known (see Water-Supply Papers Nos. 180 and 200 [a]); (*f*) either no flashboards or exceptional care in reducing leakage through them and in recording their condition.

Preferably there should be no diversion of water through or around the dam. Generally, however, the dam is built for purposes of power or navigation, and part or all of the water flowing past it is diverted for such uses. This water is measured and added to that passing over the dam. To insure accuracy in such determinations of

[a] Water-Supply Paper No. 200 replaces No. 150, the edition of which has been exhausted.

flow, the amount of water diverted should be reasonably constant. Furthermore, it should be so diverted that it can be measured, either by a weir, a current meter, or a simple system of water wheels which are of standard make or which have been rated as meters under working conditions and so installed that the gate openings, the heads under which they work, and their angular velocities may be accurately observed.

The combination of physical conditions and uses of the water should be such that the determinations of flow will not involve, for a critical stage of considerable duration, the use of a head on a broad-crested dam of less than 6 inches. Moreover, when all other conditions are good the cooperation of the owners or operators of the plant is still essential if reliable results are to be obtained.

A gaging station at a weir or dam has the general advantage of continuity of record through the period of ice and floods and the disadvantages of uncertainty of coefficient to be used in the weir formula and of complications in the diversion and use of the water.

Velocity method.—The determination of the quantity of water flowing past a certain section of a stream at a given time is termed a discharge measurement. This quantity is the product of two factors—the mean velocity and the area of the cross section. The mean velocity is a function of surface slope, wetted perimeter, roughness of bed, and the channel conditions at, above, and below the gaging section. The area depends on the contour of the bed and the fluctuations of the water surface. The two principal ways of measuring the velocity of a stream are by floats and current meters.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements, in order that the data may have the required degree of accuracy. Their essential requirements are practically the same, whether the velocity is determined by meters or floats. They are located as far as possible where the channel is straight both above and below the gaging section; where there are no cross currents, backwater, or boils; where the bed of the stream is reasonably free from large projections of a permanent character, and where the banks are high and subject to overflow only at flood stages. The station must be so far removed from the effects of tributary streams and of dams or other artificial obstructions that the gage height shall be an index of the discharge.

Certain permanent or semipermanent structures, usually referred to as equipment, are generally pertinent to a gaging station. These are a gage for determining the fluctuations of the water surface, bench marks to which the datum of the gage is referred, permanent marks on a bridge or a tagged line indicating the points of measurement, and where the current is swift some appliance (generally a secondary

cable) to hold the meter in position in the water. As a rule the stations are located at bridges if the channel conditions are satisfactory, as from them the observations can more readily be made and the cost of the equipment is small.

The floats in common use are the surface, subsurface, and tube or rod floats. A corked bottle with a flag in the top and weighted at the bottom makes one of the most satisfactory surface floats, as it is affected but little by wind. In case of flood measurements good results can be obtained by observing the velocity of floating cakes of ice or débris. In case of all surface-float measurements coefficients must be used to reduce the observed velocity to the mean velocity. The subsurface and tube or rod floats are intended to give directly the mean velocity in the vertical. Tubes give excellent results when the channel conditions are good, as in canals.

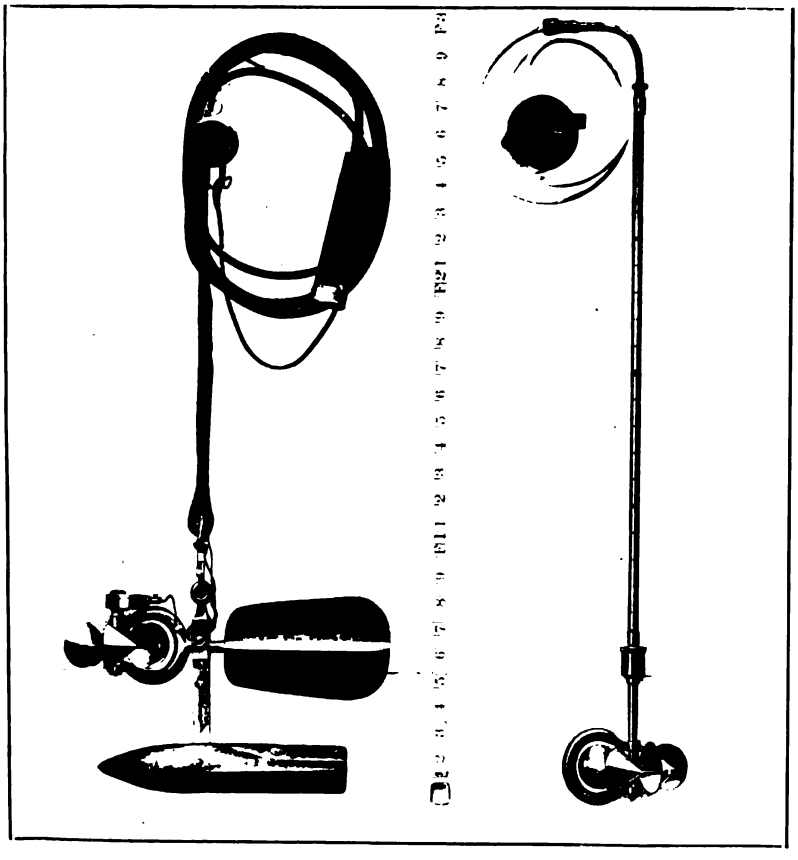
In measuring velocity by a float, observation is made of the time taken by the float to pass over the "run," a selected stretch of river from 50 to 200 feet long. In each discharge measurement a large number of velocity determinations are made at different points across the stream, and from these observations the mean velocity for the whole section is determined. This may be done by plotting the mean positions of the floats, as indicated by the distances from the bank, as ordinates, and the corresponding times as abscissas. A curve through these points shows the mean time of run at any point across the stream, and the mean time for the whole stream is obtained by dividing the area bounded by this curve and its axis by the width. The length of the run divided by the mean time gives the mean velocity.

The area used in float measurements is the mean of the areas at the two ends of the run and at several intermediate sections.

The essential parts of the current meters in use are a wheel of some type, so constructed that the impact of flowing water causes it to revolve, and a device for recording or indicating the number of revolutions. The relation between the velocity of the moving water and the revolutions of the wheel is determined for each meter. This rating is done by drawing the meter through still water for a given distance at different speeds, and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity per second for any number of revolutions.

Many kinds of current meters have been constructed. They may, however, be classed in two general types: Those in which the wheel is made up of a series of cups, as the Price, and those having a screw propeller wheel, as the Haskell. Each meter has been developed for use under some special condition. In the case of the small Price meter, shown in Pl. II, *B*, which has been largely developed and extensively used by the United States Geological Survey, an attempt

A. CURRENT-METER RATING STATION AT LOS ANGELES, CAL.



B. PRICE CURRENT METERS.

has been made to get an instrument which could be used under practically all conditions.

Current-meter measurements may be made from a bridge, a cable, a boat, or by wading, and gaging stations may be classified in accordance with such use. Fig. 1 shows a typical cable station.

In making the measurement an arbitrary number of points are laid off on a line perpendicular to the thread of the stream. The points at which the velocity and depth are observed are known as measuring points, and are usually fixed at regular intervals, varying from 2 to 20 feet, depending upon the size and condition of the stream. Perpendiculars dropped from the measuring points divide the gaging section into strips. For each strip or pair of strips the mean velocity, area, and discharge are determined independently, so that conditions existing in one part of the stream may not be extended to parts where they do not apply.

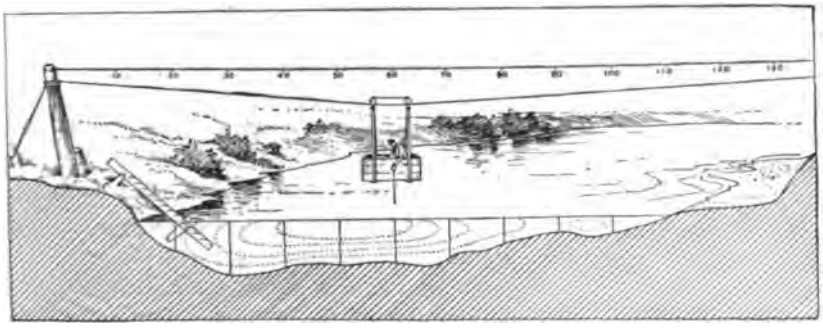


FIG. 1.—Cable station, showing section of river, car, gage, etc.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

The three principal multiple-point methods in general use are the vertical velocity-curve; 0.2 and 0.8 depth; and top, bottom, and mid-depth.

In the vertical velocity-curve method a series of velocity determinations are made in each vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve among the resulting points, the vertical velocity-curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity-curve and its axis by the depth. On account of the length of time required to make a complete measurement by this method its use is limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 of the depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity-curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 of the depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this second multiple-point method gives the mean velocity very closely for open-water conditions, and moreover the indications are that it holds nearly as well for ice-covered rivers.

In the third multiple-point method the meter is held at mid-depth, at 0.5 foot below the surface, and at 0.5 foot above the bottom, and the mean velocity is determined by dividing by 6 the sum of the top velocity, 4 times the mid-depth velocity, and the bottom velocity. This method may be modified by observing at 0.2, 0.6, and 0.8 depth.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined.

Extensive experiments by vertical velocity-curves show that the thread of mean velocity generally occurs at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, at which point the meter is held in a majority of the measurements. A large number of vertical velocity-curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be from 0.85 to 0.95, depending upon the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is specially adapted for flood measurements or when the velocity is so great that the meter can not be kept at 0.6 depth.

The vertical-integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods.

The area, which is the other factor in the velocity method of determining the discharge of a stream, depends on the stage of the river,

which is observed on the gage, and on the general contour of the bed of the stream, which is determined by soundings. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable or by a special sounding line or rod. For streams with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also of value in obtaining the area for use in computations of high-water measurements, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at various points of measurement the measuring section is divided into elementary strips, as shown in fig. 1, and the mean velocity, area, and discharge are determined separately for either a single or a double strip. The total discharge and the area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8, and vertical velocity-curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, the thickness and character of the ice, etc. From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice. For information in regard to flow under ice cover see Water-Supply Paper No. 187.

OFFICE METHODS OF COMPUTING RUN-OFF.

There are two principal methods of determining run-off, depending upon whether or not the bed of the stream is permanent.

For stations on streams with permanent beds the first step in computing the run-off is the construction of a rating table, which shows the discharge corresponding to any stage of the stream. This rating table is applied to the record of stage to determine the amount of water flowing. The construction of the rating table depends upon the method used in measuring flow.

For a station at a weir or dam the basis for the rating table is some standard weir formula. The coefficients to be used in its application

depend upon the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and assumed coefficient the discharge is computed for various heads and the rating table constructed.

The data necessary for the construction of a rating table for a velocity-area station are the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross section, the mean velocity of the current, and the quantity of water flowing. A thorough knowledge of the conditions at and in the vicinity of the station is also necessary.

The construction of the rating table depends upon the following laws of flow for open permanent channels. (1) The discharge will remain constant so long as conditions at or near the gaging station remain constant. (2) The discharge will be the same whenever the stream is at a given stage if the change of slope due to the rise and fall of the stream be neglected. (3) The discharge is a function of and increases gradually with the stage.

The plotting of results of the various discharge measurements, using gage heights as ordinates, and discharge, mean velocity, and area as abscissas, will define curves which show the discharge, mean velocity and area corresponding to any gage height. For the development of these curves there should be, therefore, a sufficient number of discharge measurements to cover the range of the stage of the stream Fig. 2 shows a typical rating curve with its corresponding mean-velocity and area curves.

As the discharge is the product of two factors, the area and the mean velocity, any change in either factor will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate sound ings extending to the limits of high water. It is always concave toward the horizontal axis or on a straight line, unless the banks of the stream are overhanging.

The form of the mean-velocity curve depends chiefly upon the surface slope, the roughness of the bed, and the cross section of the stream. Of these the slope is the principal factor. In accordance with the relative changes of these factors the curve may be either a straight line, convex or concave toward either axis, or a combination of the three. From a careful study of the conditions at any gaging station the form which the vertical velocity-curve will take can be predicted, and it may be extended with reasonable certainty to stages beyond the limits of actual measurements. Its principal use is in connection with the area curve in locating errors in discharge measurements and in constructing the rating table.

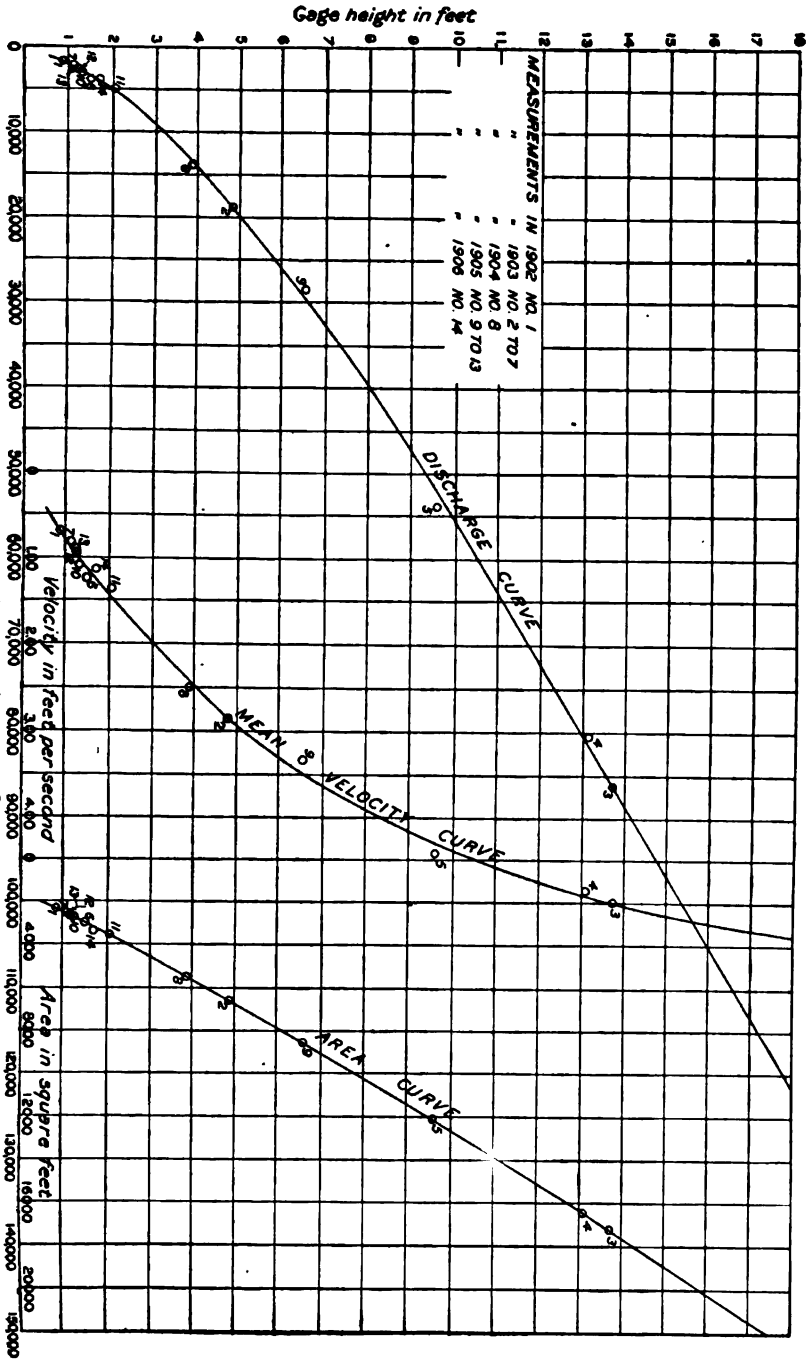


FIG. 2.—Discharge, area, and mean-velocity curves for Potomac River at Point of Rocks, Md.

The discharge curve is defined primarily by the measurements of discharge, which are studied and weighted in accordance with the local conditions existing at the time of each measurement. The curve may, however, best be located between and beyond the measurements by means of curves of area and mean velocity. The discharge curve under normal conditions is concave toward the horizontal axis and is generally parabolic in form.

In the preparation of the rating table the discharge for each tenth or half tenth on the gage is taken from the curve. The differences between successive discharges are then taken and adjusted according to the law that they shall either be constant or increasing.

The determination of daily discharge of streams with changeable beds is a difficult problem. In case there is a weir or dam available, a condition which seldom exists on streams of this class, the discharge can be determined by its use. In case of velocity-area stations frequent discharge measurements must be made if the determinations of flow are to be other than rough approximations. For stations with beds which shift slowly, or are materially changed only during floods, rating tables can be prepared for periods between such changes and satisfactory results obtained with a limited number of measurements, provided that some of them are taken soon after the change occurs. For streams with continually shifting beds, such as the Colorado and Rio Grande, discharge measurements should be made every two or three days and the discharge for intervening days obtained either by interpolation modified by gage height or by Professor Stout's method, which has been described in full in the Nineteenth Annual Report of the United States Geological Survey, Part IV, page 323, and in the Engineering News of April 21, 1904. This method, or a graphical application of it, is also much used in determining the flow at stations where the bed shifts but slowly.

COOPERATION AND ACKNOWLEDGMENTS.

Assistance has been rendered or records furnished by the following, to whom special acknowledgment is due:

H. C. Allen, special deputy State engineer representing New York State cooperation; E. A. Fisher, city engineer, and J. F. Skinner, principal assistant engineer, Utica Consolidated Water Company, Utica, N. Y.; New York Additional Water Supply Commission, J. Waldo Smith, chief engineer; Carleton E. Davis, assistant engineer.

HUDSON RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The principal sources of Hudson River lie in the wildest portion of the Adirondack Mountains, in Essex County, northeastern New York. A number of branches, any one of which might possibly be considered the main stream, form its upper waters; but if the highest collected and permanent body of water be assumed as the true head, then the

source of the Hudson becomes Lake Tear-of-the-Clouds, which lies at an elevation of 4,322 feet above tide, in the center of the triangle formed by Mounts Marcy and Skylight and Gray Peak.

The river flows rather irregularly southward until it reaches the northern boundary of Saratoga County, when it makes a sharp turn and flows eastward for about 12 miles by general course, passing through the mountains and forming, as it cuts across the rocky strata, several falls of great height and beauty. At Sandy Hill, just below Glens Falls, it makes another abrupt turn and flows southward, continuing in this direction until it empties into New York Bay.

From Lake Tear-of-the-Clouds to the mouth of the river the distance by water is probably about 300 miles. The total area drained is 13,370 square miles. The river is tidal to Troy, which is also at the head of navigation.

The fall in the upper portion of the course is very rapid, amounting to about 64 feet per mile from Lake Tear-of-the-Clouds to North Creek, a distance of about 52 miles. From the mouth of North Creek to the mouth of the Sacondaga the descent is nearly 14 feet per mile, distributed among rapids which diminish in frequency as the Sacondaga is approached. In the succeeding 26 miles to Fort Edward the river descends 418 feet more, but of this 175 feet is comprised in the three abrupt pitches at Palmer, Glens, and Bakers falls, while most of the remainder occurs in the rapids between Jessups Landing and the oxbow above Glens Falls. Between Glens Falls and Troy nearly the entire fall of the river is utilized for the development of water power.

The tributaries of the Hudson are numerous, and many of them are large and important. Indian River, Schroon River, and the Sacondaga unite with the main stream above Glens Falls, and between the latter point and Troy it receives Batten Kill, Fish Creek, Hoosic River, and the Mohawk. The tributaries below Troy include Catskill, Esopus, and Rondout creeks, and Wallkill River from the west, and Kinderhook Creek, Jansen Kill, Wappinger Creek, Fishkill Creek, and Croton River from the east.

Mohawk River, the largest of the tributary streams, rises in the sandy hills south of Booneville, in western New York, about 40 miles from the east end of Lake Ontario. Its uppermost tributaries are fed by large springs, and in addition the stream receives considerable water brought in from the adjacent Black River drainage basin for the supply of the Black River and Erie canals.

The Mohawk flows southward until it reaches the city of Rome, at which point it turns to the east, flowing across the State in a course a little east of south until it enters the Hudson at Cohoes, a few miles above Troy. It has a length by actual course of 140 to 145 miles, and a drainage area, measured at the mouth, of 3,470 square miles.

Above Rome the Mohawk flows through a deep gorge in shale rock; from Rome eastward to Little Falls the valley is deeply filled with alluvial deposits, and the flood plains on either side become submerged during freshets, thus acting to some extent as storage reservoirs. At Little Falls the river cuts through a rocky gorge, whose walls rise precipitously 500 or 600 feet.

Below Rome the fall of the river is small and rather uniform, being made up of long, quiet reaches with slight riffles; but at Little Falls this uniformity is broken, and the stream descends in a succession of falls about 45 feet in less than half a mile. The average fall between Rome and the lower aqueduct at Crescent, a distance of 110.7 miles, is 2.43 feet per mile; thence to the level of slack water above Troy dam there is a further descent of 149.5 feet in 4.4 miles, but of this 105 feet is included in the improved power at Cohoes.

The principal tributaries of the Mohawk below the source are successively, Oriskany, West Canada, East Canada, and Schoharie creeks.

The Erie Canal runs parallel to the Mohawk through most of its course below Rome and derives a part of its water supply from the river. Feeder dams for purposes of diversion are located on the river at Delta, Rome, Little Falls, Rocky Rift, and Rexford Flats. A dam at Oriskany Creek also diverts into the canal a portion of the flow of that tributary, as well as waters brought into the Mohawk basin from storage reservoirs located in the upper drainage basin of Chenango River near Hamilton, N. Y. There is also a diversion dam near the mouth of Schoharie Creek, the largest tributary of the Mohawk.

The annual precipitation in the Hudson River basin, as determined by observations at twelve or more stations, is about 37 inches, but the amount is undoubtedly much greater in the elevated country near the headwaters.

The flow of the upper Hudson is controlled to some extent during the dry season by the use of Indian Lake storage reservoir, and the facilities for storage works in this part of the basin are unsurpassed. The entire region is dotted with ponds and lakes, many of them of large size and fed from extensive drainage areas. Saratoga Lake serves as a regulator of Fish Creek, and there is a small reservoir at the headwaters of the Hoosic. Storage is also extensively developed in the basin of Croton River for the purpose of supplying the city of New York with water. The flow of the Mohawk above the gaging stations at Little Falls and Dunsbach Ferry is modified during the season of canal navigation, extending from about May 1 to December 1.

Except that of the Delaware, the basin of the Hudson contains a greater population in proportion to its size than any other important river basin in the United States. This population is largely concentrated along the great highway of traffic which follows the valley of the Mohawk from the west and then continues down the lower Hudson.

HUDSON RIVER AT FORT EDWARD, N. Y.

This station was established in 1895, in connection with the upper Hudson storage surveys. It is located at the dam of the International Paper Company. A new and accurate profile of the crest of the dam, obtained in 1906, has been used to determine the discharge. The conditions at the station are described in the annual reports of the State engineer and surveyor of New York, and in Water-Supply Paper No. 166, page 18, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Hudson River at Fort Edward, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	8,392	9,962	6,343	10,763	12,006	10,837	7,940	3,662	2,175	3,143	3,168	3,843
2	7,569	5,937	5,338	10,532	12,637	7,723	13,065	3,171	3,756	2,738	3,293	5,902
3	5,740	5,586	4,351	10,147	13,658	8,529	11,354	4,229	5,006	2,616	1,693	4,355
4	5,674	5,548	10,572	10,579	13,275	8,782	9,046	1,685	2,904	2,882	4,274	4,016
5	6,434	5,995	12,421	12,110	13,280	5,845	10,672	3,563	1,931	2,409	2,630	2,366
6	5,461	4,139	10,709	11,517	12,959	4,781	9,208	4,030	5,124	2,063	2,207	2,803
7	8,703	3,876	10,058	10,339	12,639	5,140	5,913	3,634	3,193	3,810	2,763	3,887
8	6,266	4,425	9,309	10,070	11,629	6,287	7,351	2,870	2,215	2,653	2,660	3,382
9	3,891	4,348	8,632	10,579	12,386	7,105	6,728	2,630	4,091	2,493	2,738	3,289
10	3,469	2,160	7,264	9,358	11,376	10,262	5,156	2,432	3,871	2,291	1,320	3,051
11	3,154	6,030	6,858	8,217	11,054	11,356	5,240	1,666	2,843	2,616	4,091	2,099
12	3,540	5,492	6,534	8,383	9,389	12,976	4,841	769	2,739	2,368	2,904	2,520
13	2,200	4,054	6,229	8,968	9,550	9,126	4,552	2,468	2,728	1,172	3,478	2,396
14	6,030	4,548	4,520	10,741	12,384	7,977	2,188	2,354	2,259	3,588	2,127	2,565
15	5,740	4,590	4,327	22,379	14,774	7,171	5,642	1,694	1,816	2,491	2,930	2,881
16	4,351	3,775	4,253	23,026	11,753	2,262	5,865	1,512	3,233	2,409	3,025	1,972
17	4,742	1,493	2,083	27,046	9,556	5,865	3,744	1,602	2,697	2,572	4,459	4,991
18	4,640	6,984	5,672	27,687	10,087	9,108	3,311	830	2,638	2,572	6,534	3,994
19	3,720	4,821	4,779	27,687	9,642	8,533	3,238	4,094	2,616	2,409	4,140	3,950
20	1,726	4,343	3,881	28,467	9,837	8,442	2,289	2,284	2,904	1,871	4,260	3,419
21	6,374	3,730	3,208	27,023	8,618	7,237	870	3,644	2,885	2,235	6,346	3,744
22	7,397	4,371	3,490	25,000	7,890	5,928	324	3,092	1,756	6,951	7,034	3,364
23	8,014	5,795	3,705	26,796	5,238	4,892	4,226	3,707	4,091	4,245	8,521	5,604
24	14,158	5,498	2,216	24,096	7,253	8,180	2,892	3,634	3,456	3,781	7,009	5,845
25	18,047	6,984	5,139	20,824	7,981	8,910	2,718	1,896	2,867	3,787	7,115	2,235
26	17,080	8,069	3,429	17,726	8,076	6,816	2,325	1,546	2,225	3,146	7,789	3,825
27	14,350	7,640	3,764	14,875	9,979	6,172	2,026	4,924	2,742	2,412	6,203	2,390
28	13,788	7,274	4,916	11,009	14,811	4,353	1,116	3,512	2,823	4,823	6,268	2,718
29	12,314	.....	9,163	11,523	14,342	3,818	4,187	3,405	1,823	6,555	7,461	2,906
30	12,197	.....	9,556	11,517	12,637	1,674	4,743	2,910	3,501	3,953	7,539	1,841
31	9,872	.....	9,746	.....	12,384	.....	3,515	3,549	.....	3,522	.....	4,343

Monthly discharge of Hudson River at Fort Edward, N. Y., for 1906.

[Drainage area, 2,800 square miles.]

Month.	Discharge in second-feet			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	18,000	1,730	7,580	2.71	3.12
February	9,960	1,490	5,270	1.88	1.96
March	12,400	2,080	6,210	2.22	2.56
April	28,500	8,220	16,300	5.82	6.49
May	14,800	5,240	11,100	3.96	4.56
June	13,000	1,670	7,200	2.57	2.87
July	13,100	324	5,040	1.80	2.08
August	4,920	769	2,810	1.00	1.15
September	5,120	1,760	2,970	1.06	1.18
October	6,950	1,470	3,130	1.12	1.29
November	8,520	1,320	4,440	1.59	1.77
December	5,900	1,840	3,440	1.23	1.42
The year	28,500	324	6,290	2.25	30.45

HUDSON RIVER AT MECHANICSVILLE, N. Y.

A record of the flow of Hudson River at Mechanicsville has been kept by the Duncan Company since December, 1888. The record includes two daily readings of the depth on the crest of the dam and a continuous record of the run of the water wheels in the adjoining paper mill. The accompanying tables, computed by Mr. R. P. Bloss, the engineer of the company, show the daily and monthly mean flow at Mechanicsville. The conditions at the station are described in Water-Supply Paper No. 166, page 20, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Hudson River at Mechanicsville, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	9,079	10,307	7,212	15,894	14,105	14,947	7,238	4,753	8,441	3,170	4,318	6,571
2	7,066	9,631	7,176	14,263	12,941	13,222	13,393	4,647	2,324	2,879	4,134	5,492
3	6,614	6,768	7,064	12,720	16,631	11,554	12,086	4,067	1,581	3,155	3,944	6,363
4	7,207	3,924	23,939	12,882	15,984	10,675	9,450	4,251	3,511	3,189	2,447	4,443
5	8,548	6,599	13,643	15,297	15,863	8,895	10,816	3,092	3,284	3,166	3,770	4,479
6	6,303	5,939	11,157	15,338	16,306	8,107	9,440	4,049	3,012	2,735	3,499	3,635
7	6,575	6,276	10,672	15,276	14,111	8,342	8,880	4,126	4,313	1,431	3,457	5,315
8	7,388	6,187	10,050	12,398	12,750	8,232	5,853	4,160	3,906	3,342	3,535	5,208
9	5,861	6,470	10,443	13,956	12,957	8,246	6,399	3,801	2,414	3,121	3,398	4,029
10	5,609	6,770	9,943	14,230	10,155	10,567	6,118	3,695	3,438	2,942	3,228	3,690
11	5,804	4,317	7,814	14,544	13,017	12,781	6,000	2,610	3,218	2,878	2,150	4,447
12	5,818	5,822	9,130	14,110	12,465	14,395	6,032	2,468	3,308	2,868	3,814	3,737
13	7,685	5,690	7,487	13,704	10,145	10,110	5,773	3,989	3,161	2,745	4,256	4,444
14	5,820	5,548	7,021	16,309	12,722	8,608	5,432	3,912	2,753	872	4,589	4,312
15	7,204	6,222	7,432	21,897	12,701	8,273	3,069	3,160	2,797	2,879	3,740	4,579
16	6,132	5,883	6,008	40,279	13,615	8,379	4,765	3,308	620	2,818	3,751	4,723
17	7,600	5,484	6,391	33,922	11,419	7,487	4,979	2,926	3,314	2,414	3,958	5,989
18	6,599	5,183	4,109	33,159	11,087	9,928	5,399	2,562	3,063	2,869	2,724	5,954
19	6,297	7,418	6,455	31,888	10,877	9,928	4,672	585	3,086	2,837	7,038	5,258
20	5,818	6,101	6,159	31,522	8,964	8,925	4,395	2,872	3,108	2,858	7,782	5,406
21	4,929	6,014	5,668	31,104	8,573	7,699	3,770	2,540	3,097	3,116	7,347	4,777
22	9,849	12,280	5,694	29,575	8,507	6,907	187	2,976	3,108	5,711	8,535	5,729
23	11,564	10,643	5,670	29,046	7,545	6,780	4,025	3,279	2,328	5,086	8,632	4,096
24	22,043	9,426	5,129	28,147	7,511	10,152	4,585	3,318	6,497	4,467	8,549	4,386
25	20,426	7,817	2,830	23,723	8,079	10,185	4,449	3,343	3,321	4,224	5,903	4,582
26	17,912	13,489	4,993	20,240	9,600	8,243	3,811	2,451	3,246	4,400	7,658	4,778
27	17,119	10,842	11,405	18,732	12,348	7,600	3,855	4,486	3,032	4,251	6,976	4,454
28	13,925	17,155	16,972	16,488	26,892	6,849	3,794	4,737	3,233	3,153	6,572	4,440
29	14,137	.....	15,979	12,718	27,833	6,369	1,738	4,410	3,166	5,371	7,149	3,997
30	10,972	.....	13,063	14,514	20,204	6,302	3,865	4,054	1,435	4,709	6,964	5,348
31	10,564	.....	14,364	.....	18,135	.....	4,927	3,333	.....	4,508	.....	6,345

Monthly discharge of Hudson River at Mechanicsville, N. Y., for 1906.

[Drainage area, 4,500 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec. ft. per sq. mile.	Depth in inches.
January	22,000	4,930	9,310	2.07	2.39
February	17,200	3,920	7,650	1.70	1.77
March	23,900	2,830	9,000	2.00	2.31
April	40,300	12,400	20,600	4.58	5.11
May	27,800	7,510	13,400	2.98	3.44
June	14,900	6,300	9,290	2.06	2.30
July	13,400	187	5,780	1.28	1.48
August	4,750	585	3,480	.773	.89
September	6,500	620	3,070	.682	.76
October	5,710	872	3,370	.749	.86
November	8,630	2,150	5,130	1.14	1.27
December	6,570	3,640	4,870	1.08	1.25
The year	40,300	187	7,910	1.76	23.82

INDIAN LAKE RESERVOIR AT INDIAN LAKE, NEW YORK.

A record of the stage of water in Indian Lake reservoir, located in the upper Hudson River basin, as described in preceding reports, has been continued. The conditions at the station are described in Water-Supply Paper No. 166, page 24, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Indian Lake reservoir, at Indian Lake, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	33.42	31.75	23.83	15.54	28.33	32.50	34.25	32.71	26.83	16.75	10.04	6.83
2	33.50	31.58	23.54	15.33	28.83	32.42	34.50	32.58	26.58	16.42	9.83	6.67
3	33.58	31.42	23.25	15.17	29.25	32.33	34.62	32.54	26.42	16.17	9.67	6.50
4	33.67	31.25	23.00	15.17	29.67	32.25	34.62	32.50	26.25	15.92	9.50	6.75
5	33.75	30.92	22.92	15.33	30.08	32.33	34.58	32.42	26.08	15.67	9.29	7.00
6	33.79	30.75	22.58	15.58	30.38	32.42	34.62	32.33	25.92	15.42	9.08	7.08
7	33.83	30.46	22.29	15.75	30.67	32.50	34.58	32.25	25.42	15.08	8.92	7.25
8	33.88	30.17	22.00	15.92	30.92	32.67	34.58	32.13	25.00	14.75	8.75	7.50
9	33.92	29.92	21.67	16.04	31.12	32.83	34.54	32.00	24.92	14.50	8.58	7.75
10	33.71	29.62	21.33	16.17	31.33	32.92	34.50	31.92	24.17	14.25	8.42	7.92
11	33.50	29.33	21.00	16.33	31.50	32.42	34.50	31.83	23.75	14.00	8.25	8.08
12	33.29	29.00	20.67	16.50	31.75	32.50	34.46	31.71	23.33	13.75	8.13	8.17
13	33.08	28.67	20.33	16.67	32.00	32.58	34.42	31.58	22.92	13.50	8.00	8.25
14	32.92	28.33	20.00	16.92	32.25	32.62	34.42	31.42	22.58	13.25	7.83	8.33
15	32.75	28.00	19.79	17.67	32.46	32.67	34.38	31.29	22.21	13.00	7.62	8.00
16	32.58	27.71	19.42	18.67	32.67	32.75	34.33	31.21	21.83	12.75	7.50	7.75
17	32.42	27.42	19.21	19.50	32.62	32.88	34.29	31.13	21.50	12.50	7.38	7.58
18	32.17	27.08	19.00	20.50	32.58	33.00	34.25	31.00	21.08	12.25	7.25	7.42
19	32.00	26.83	18.67	21.50	32.50	33.08	34.21	30.83	20.67	12.00	7.25	7.25
20	31.83	26.58	18.33	22.58	32.38	33.17	34.17	30.58	20.33	12.00	7.25	7.00
21	31.75	26.33	18.00	23.58	32.25	33.21	34.13	30.29	20.00	11.88	7.21	6.83
22	31.67	26.08	17.79	24.58	32.17	33.33	33.92	29.92	19.62	11.67	7.25	6.67
23	31.75	25.67	17.42	25.50	32.08	33.42	33.83	29.58	19.25	11.50	7.25	6.50
24	32.08	25.42	17.25	25.96	32.08	33.50	33.67	29.17	18.92	11.25	7.29	6.33
25	32.33	25.08	17.00	26.42	32.17	33.58	33.42	28.83	18.58	11.21	7.25	6.17
26	32.42	24.75	16.75	26.83	32.33	33.62	33.29	28.50	18.25	11.08	7.21	6.00
27	32.42	24.42	16.58	27.17	32.54	33.67	33.17	28.25	17.92	10.96	7.17	5.83
28	32.33	24.08	16.33	27.42	32.67	33.75	33.08	28.00	17.58	10.88	7.08	5.67
29	32.21	.....	16.08	27.67	32.75	33.83	33.00	27.67	17.25	10.67	7.00	5.50
30	32.08	.....	15.92	28.00	32.67	33.92	32.92	27.33	17.00	10.54	6.92	5.33
31	31.96	.....	15.75	.....	32.58	.....	32.83	27.08	.....	10.25	.....	5.29

NOTE.—The reservoir gates were open during the greater portion of the year, the closed period being as follows: January 1 to 7, April 5 to May 11, July 4 to 18, December 5 to 13.

HOOSIC RIVER AT BUSKIRK, N. Y.

This station was established September 25, 1903, at the highway bridge in Buskirk village. The conditions and the bench marks are described in Water-Supply Paper No. 166, page 25, where are given also references to publications that contain data for previous years.

Discharge measurements of Hoosic River at Buskirk, N. Y., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec. ft.*
February 10[a]	Covert & Weeks	130	576	3.90	709
August 3	C. C. Covert	126	377	1.90	336
August 22	do	126	377	1.86	328
October 10	do	115	328	1.50	171

[a] River frozen over, average thickness of ice 0.51 foot; considerable needle ice. Gage height to bottom of ice, 3.26 feet.

Daily gage height, in feet, of Hoosic River at Buskirk, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.52	2.68	2.60	3.55	2.95	3.52	2.42	2.50	1.60	1.55	1.85	2.42
2	2.50	2.68	2.70	3.32	3.32	3.15	2.35	2.12	1.55	1.55	1.80	2.25
3	2.55	3.75	2.65	3.25	4.20	3.10	2.95	2.08	1.48	1.60	1.72	2.28
4	2.62	3.82	8.05	3.30	3.50	2.90	2.80	2.02	1.85	1.50	1.65	3.45
5	2.82	4.00	4.15	4.25	3.05	2.65	2.75	2.10	1.75	1.55	1.75	3.40
6	2.80	3.58	3.25	4.28	3.15	2.92	2.55	2.05	1.68	1.48	1.88	3.65
7	2.52	3.80	3.05	3.85	3.15	2.58	2.42	2.02	1.65	1.30	1.68	5.90
8	2.68	3.68	2.55	3.38	2.95	3.10	2.20	2.02	1.65	1.38	1.80	4.35
9	2.40	3.70	2.92	3.80	3.25	3.22	2.28	1.85	1.40	1.35	1.70	4.60
10	2.50	3.70	2.65	3.88	4.05	4.05	2.25	1.90	1.55	1.80	1.65	4.95
11	4.22	3.52	2.45	4.45	3.42	4.25	2.22	1.98	1.52	1.90	1.72	4.60
12	3.95	3.65	2.50	4.35	3.20	3.40	2.08	2.10	1.52	1.92	2.50	4.40
13	3.42	3.65	2.30	4.25	3.02	2.90	2.10	2.05	1.55	1.82	2.25	4.75
14	2.82	3.68	2.45	4.48	3.45	2.72	1.98	1.90	1.62	1.68	2.20	4.42
15	2.65	3.68	2.35	8.90	3.02	2.65	1.78	1.80	1.62	1.72	1.88	4.50
16	2.48	3.55	2.40	9.35	2.90	2.52	1.78	1.65	1.48	1.68	1.90	5.55
17	2.88	3.60	2.35	6.10	2.78	2.62	1.95	1.65	1.38	1.60	1.85	5.38
18	2.60	3.32	2.10	5.38	2.72	2.82	2.85	1.50	1.30	1.60	1.82	4.70
19	2.55	3.52	2.30	5.08	2.58	2.58	2.30	1.40	1.40	1.60	4.30	4.45
20	2.32	3.60	2.28	4.90	2.58	2.50	2.15	1.52	1.28	2.52	3.42	4.38
21	3.02	3.85	2.25	4.48	2.48	2.50	2.00	1.70	1.40	3.05	3.15	4.75
22	3.70	6.85	2.22	4.28	2.35	2.32	2.02	1.80	1.55	2.48	3.35	4.90
23	5.38	3.95	2.20	4.05	2.28	2.40	2.10	1.82	1.85	2.22	3.28	.....
24	6.50	3.40	2.25	3.80	2.30	4.30	2.40	1.75	1.98	2.12	3.15	.....
25	4.15	3.25	2.00	3.70	2.35	3.18	2.18	1.62	1.75	2.00	2.70	.....
26	3.58	4.85	2.35	3.40	2.52	2.55	1.90	1.52	1.62	2.28	2.60	.....
27	3.32	3.45	6.60	3.25	4.40	2.45	1.92	1.60	1.70	2.10	2.50	.....
28	3.05	2.65	5.55	3.15	8.59	2.30	1.82	2.02	1.65	2.02	2.52	.....
29	2.92	.....	3.90	2.95	6.55	2.32	1.80	1.82	1.65	2.22	2.40	.....
30	2.82	.....	3.60	2.95	4.82	2.40	2.00	1.75	1.48	1.95	2.40	.....
31	2.78	.....	3.80	.....	4.10	.....	*2.50	1.65	.....	2.08	.....	.....

NOTE.—Ice conditions January 10-13: River frozen over solid at bridge February 1 to 22; ice from 0.3 to 0.75 foot thick. Ice went out of river during night of February 22. No ice in river during March except anchor ice. Anchor ice January 1, 2, 7, and 26, February 10 and 11, March 15, 16, and 19.

Ice conditions in December: Anchor ice running from December 3 to 8. December 9 gage height was to ice surface; December 17 the river was frozen over solid, and records were discontinued. Ice went out of river December 31.

During the frozen period of January and February readings were taken to water surface through hole cut in ice; for December readings were to top of ice.

Rating table for Hoosic River at Buskirk, N. Y., for 1903–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	74	2.40	642	3.60	1,614	5.60	4,040
1.30	106	2.50	704	3.70	1,716	5.80	4,320
1.40	140	2.60	769	3.80	1,822	6.00	4,600
1.50	176	2.70	837	3.90	1,930	6.20	4,890
1.60	216	2.80	909	4.00	2,040	6.40	5,180
1.70	260	2.90	985	4.20	2,265	6.60	5,480
1.80	308	3.00	1,065	4.40	2,495	6.80	5,780
1.90	359	3.10	1,149	4.60	2,735	7.00	6,080
2.00	412	3.20	1,236	4.80	2,985	8.00	7,630
2.10	467	3.30	1,326	5.00	3,240	9.00	9,230
2.20	524	3.40	1,419	5.20	3,500	10.00	10,880
2.30	582	3.50	1,515	5.40	3,770		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1906, and is fairly well defined between gage heights 1.6 feet and 7.0 feet.

Monthly discharge of Hoosic River at Buskirk, N. Y., for 1906.

[Drainage area, 579 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January[a]	5,330	.....	1,150	1.99	2.29
February[b]	.....	.....	1,030	1.78	1.85
March	7,710	412	1,330	2.30	2.65
April	9,810	1,020	2,580	4.46	4.98
May	8,570	570	1,610	2.78	3.20
June	2,380	582	1,030	1.78	1.99
July	1,020	298	545	.941	1.08
August	704	140	339	.585	.67
September	401	100	214	.370	.41
October	1,110	106	357	.617	.71
November	2,380	74	600	1.04	1.16
December[c]	.....	.....	.....	.....	.....

[a] Ice conditions January 10 to 13; discharge estimated 600 second-feet. Assumed that anchor ice did not materially affect the flow.

[b] Ice conditions February 1 to 22; discharge estimated 700 second-feet February 1 to 21, and 4,000 second-feet February 22 on the assumption that there was more or less back water due to ice conditions.

[c] A comparison of the flow at this station from December 1 to 22 with that of the Mohawk River at Dunsbach Ferry Bridge indicates that the mean flow for December was less than 750 second-feet.

NOTE.—Values are rated as follows: January, good; February, fair; March to November, excellent.

MOHAWK RIVER AT LITTLE FALLS, N. Y.

This station is located at the lower (Gilbert's) dam at Little Falls, N. Y. The conditions are described in Water Supply Paper No. 166, page 28, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Mohawk River at Little Falls, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	July.	Day.	Jan.	Feb.	Mar.	Apr.	May.	July.
1	3,560	2,590	1,820	6,410	2,160	574	17	2,690	1,060	1,140	10,730	1,770	903
2	3,470	1,590	1,660	4,830	1,810	1,120	18	2,240	1,140	1,130	8,790	1,570	1,040
3	2,080	839	1,520	3,130	5,910	3,560	19	2,290	1,210	921	6,880	1,400	810
4	1,990	1,210	5,810	3,580	5,820	4,960	20	1,960	1,210	914	6,520	842	704
5	3,790	1,270	5,000	5,450	4,270	3,570	21	3,030	2,910	1,020	6,950	796	600
6	3,820	1,110	5,000	5,380	3,860	2,620	22	6,780	5,240	1,140	7,620	649	496
7	2,610	1,100	3,590	4,300	2,320	1,500	23	10,690	4,980	921	7,140	684	741
8	2,080	1,100	2,610	3,240	1,710	725	24	16,700	5,190	1,020	4,740	766	701
9	1,480	1,180	2,420	2,630	2,090	1,760	25	14,200	4,930	958	3,210	684	626
10	1,480	1,190	2,730	3,020	2,040	2,320	26	8,450	5,400	1,100	2,400	734	653
11	1,620	1,210	2,180	5,020	1,980	3,400	27	5,920	5,290	5,960	3,120	3,290	549
12	2,080	1,070	1,780	5,950	1,460	2,150	28	4,260	3,400	11,010	2,540	4,920	587
13	2,270	1,140	1,590	5,380	1,480	1,090	29	2,770	.....	10,900	3,220	3,510	427
14	2,230	1,220	1,350	5,420	4,590	726	30	2,130	.....	7,950	2,410	2,030	729
15	2,080	1,180	1,150	12,100	3,700	725	31	2,580	.....	7,620	.....	1,170	1,270
16	2,070	1,220	1,030	12,020	1,980	905							

NOTE.—January 24 and 25, discharge approximate.

Monthly discharge of Mohawk River at Little Falls, N. Y., for 1906.

[Drainage area, 1,310 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	16,700	1,480	4,040	3.08	3.55
February	5,400	839	2,220	1.70	1.77
March	11,000	914	3,060	2.34	2.70
April	12,100	2,400	5,470	4.18	4.66
May	5,910	649	2,320	1.77	2.04
July	4,960	427	1,390	1.06	1.22

MOHAWK RIVER AT DUNSBACH FERRY BRIDGE, NEW YORK.

This station was established March 12, 1898, for the primary purpose of checking a system of levels for the United States Board of Engineers on Deep Waterways, by D. J. Howell, civil engineer, who has furnished the earlier portion of the record. The station is located at the dam of the West Troy Water Company, one-fifth mile above Dunsbach Ferry Bridge, 9 miles from the mouth of the river. The conditions at the station are described in Water Supply Paper No. 166, page 29, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Mohawk River at Dunsbach Ferry Bridge, New York, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7,181	4,757	4,841	20,351	5,440	5,921	4,191	1,871	1,641	1,411	3,101	6,681
2	5,617	3,591	4,191	14,691	5,660	5,061	8,721	1,871	1,411	1,411	2,931	6,171
3	3,897	2,931	3,981	11,861	11,374	4,191	7,941	1,871	1,411	1,641	2,761	5,701
4	3,507	2,271	30,723	10,681	14,430	3,591	5,701	1,761	1,301	1,411	2,761	3,261
5	5,407	2,601	19,779	14,691	11,507	3,261	5,061	1,641	1,181	1,301	2,601	2,601
6	7,857	2,101	13,160	15,031	9,841	3,261	4,841	1,761	951	1,181	2,431	2,601
7	7,097	2,271	10,804	16,401	8,721	3,761	3,981	2,761	1,066	1,181	2,101	3,761
8	4,977	2,761	7,845	11,861	6,681	3,261	3,261	2,431	1,181	1,521	1,981	4,621
9	2,847	2,761	6,931	9,561	5,701	3,101	2,761	2,271	1,066	1,641	1,871	4,191
10	2,347	2,761	6,681	9,281	5,701	3,261	2,601	1,981	951	1,787	1,981	3,431
11	2,677	2,601	6,171	15,711	6,421	4,977	3,761	1,871	841	1,787	2,101	3,101
12	3,347	2,761	5,491	22,041	5,921	5,617	5,271	1,521	841	2,017	2,431	3,101
13	4,537	2,761	4,411	21,309	5,271	5,187	3,981	1,411	841	2,517	3,261	3,431
14	5,187	2,601	3,761	18,131	5,061	3,794	3,261	1,411	841	2,347	3,431	3,101
15	4,537	2,761	3,431	21,621	7,681	3,196	3,101	1,181	841	2,187	3,761	2,931
16	4,537	2,761	3,460	36,541	6,681	4,841	2,761	1,181	841	1,897	3,591	3,761
17	4,757	2,431	3,261	26,661	5,271	6,681	2,761	1,181	786	1,787	3,101	9,001
18	4,537	2,431	3,101	22,251	4,621	9,561	2,271	1,181	731	1,787	2,931	8,721
19	4,327	2,431	3,101	18,871	4,191	8,721	2,101	1,066	730	1,871	6,171	7,431
20	3,897	2,761	2,761	17,081	3,761	7,681	1,981	951	730	2,101	17,421	6,421
21	4,107	3,101	2,601	16,061	3,261	5,701	1,871	1,066	730	3,761	13,421	5,271
22	7,597	6,931	2,271	15,371	3,101	3,981	1,871	1,181	896	6,681	12,801	3,761
23	19,897	17,761	2,101	15,031	2,761	3,591	1,871	1,181	1,301	5,271	10,961	3,761
24	29,937	12,801	2,389	13,421	2,601	3,431	1,641	1,521	1,521	3,261	8,721	3,761
25	25,327	11,861	2,347	10,681	2,431	3,101	1,641	1,521	1,761	2,761	7,181	3,431
26	16,997	14,041	2,347	8,721	2,431	3,101	1,641	1,521	1,761	2,931	5,921	3,261
27	12,717	10,961	3,431	7,681	2,761	2,761	1,411	1,761	1,641	3,101	6,171	2,931
28	9,197	6,931	47,850	6,931	21,461	2,761	1,411	1,981	1,411	3,101	6,421	2,761
29	7,097	.....	24,360	6,421	18,131	2,601	1,641	2,101	1,521	3,101	6,931	2,761
30	4,977	.....	21,777	5,921	12,171	2,271	1,641	1,871	1,521	3,261	7,431	2,931
31	4,977	.....	25,737	.....	7,681	.....	1,871	1,761	.....	3,431	.....	3,591

Monthly discharge of Mohawk River at Dunsbach Ferry, New York, for 1906.

[Drainage area, 3,440 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	29,900	2,350	7,610	2.21	2.55
February	17,800	2,100	4,980	1.45	1.51
March	47,800	2,100	9,200	2.67	3.08
April	36,500	5,920	15,500	4.51	5.03
May	21,500	2,430	7,060	2.05	2.36
June	9,560	2,270	4,410	1.28	1.43
July	8,720	1,410	3,190	.927	1.07
August	2,760	951	1,630	.474	.55
September	1,760	730	1,140	.331	.37
October	6,680	1,180	2,430	.706	.81
November	17,400	1,870	5,290	1.54	1.72
December	9,000	2,600	4,270	1.24	1.43
Total	47,800	730	5,560	1.62	21.91

NOTE.—Values for this station are in general considered as good, although occasionally during the winter months the flow is obstructed by ice, causing temporary errors greater than 10 per cent.

ORISKANY CREEK, AT COLEMAN, N.Y.

A station was established, June 5, 1901, at Wood Road Bridge, 1 mile above the village of Oriskany, and was discontinued November 30, 1904, a new station having been established at Coleman, 1 mile upstream, where a cableway was erected for use in making current-meter measurements during high water. Observations at the cable station were begun August 13, 1904, and discontinued April 30, 1906. The conditions at the latter station and the bench marks are described in Water-Supply Paper No. 166, page 31, where are given also references to publications that contain data for previous years.

The following discharge measurement was made September 17, 1906:

Width, 75 feet; area, 79 square feet; gage height, 0.49 foot; discharge, 110 second-feet.

Daily gage height, in feet, of Oriskany Creek, at Coleman, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	1.78	1.60	1.30	2.05	1.02	17	1.70	1.32	0.82	1.48	.....
2	1.78	1.32	1.30	1.88	1.05	18	1.72	1.52	1.22	1.35	.....
3	1.70	1.28	1.10	1.62	.....	19	1.75	1.48	0.92	1.60	.....
4	2.25	1.20	2.95	1.80	.....	20	1.52	1.15	1.20	1.52	.....
5	2.10	1.35	1.78	2.75	.....	21	3.05	3.55	1.18	1.48	.....
6	1.95	1.25	1.32	2.35	.....	22	3.15	2.15	1.08	1.55	.....
7	1.58	1.48	1.48	2.00	.....	23	2.85	2.02	1.40	1.12	.....
8	1.90	1.45	1.32	1.85	.....	24	3.45	1.75	1.15	1.38	.....
9	1.78	1.50	1.32	1.95	.....	25	2.15	1.82	1.10	1.25	.....
10	1.95	1.32	1.22	2.65	.....	26	1.45	2.05	1.20	1.18	.....
11	2.70	1.10	1.22	2.65	.....	27	1.45	1.50	3.30	1.20	.....
12	2.00	1.58	1.20	2.35	.....	28	1.65	1.05	2.50	1.15	.....
13	1.90	1.50	1.15	2.02	.....	29	1.48	.....	2.10	1.12	.....
14	1.65	1.40	1.12	1.92	.....	30	1.70	.....	2.35	1.20	.....
15	1.65	1.38	1.05	2.80	.....	31	1.70	.....	2.95	.....	.....
16	1.50	1.20	1.22	2.10	.....						

NOTE.—Ice conditions from January 1 to March 20 approximately; thickness varied from 0.1 foot to 1 foot; creek frozen over most of the time.

STARCH FACTORY CREEK NEAR NEW HARTFORD, N. Y.

A gaging weir was erected on this creek above the head of the former Savage reservoir May 26, 1903. The conditions at the station are described in Water-Supply Paper No. 166, page 33, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Starch Factory Creek, near New Hartford,[a] N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.27	1.41	0.97	5.00	1.41	1.29	2.34	0.47	0.39	1.01	1.53	5.95
2	2.65	.97	.97	4.45	4.82	1.29	1.41	.39	.31	.91	1.35	2.72
3	2.34	.86	1.29	5.57	31.0	1.29	1.06	.47	.39	.64	1.17	2.34
4	8.76	.97	4.28	13.95	5.38	1.06	2.34	.47	.39	.43	1.06	1.78
5	5.38	1.06	2.06	16.56	12.43	.86	1.29	.47	.31	3.76	.97	1.78
6	3.59	.97	5.19	11.47	4.28	.86	.86	.47	.31	1.92	.97	5.47
7	2.95	.97	2.50	6.75	3.59	.86	.75	.47	.31	4.64	.86	5.28
8	2.34	.97	2.06	6.97	2.65	2.34	.64	.47	.31	1.41	.75	2.20
9	2.20	1.06	2.50	4.64	2.65	2.06	2.80	.39	.31	1.35	.75	1.53
10	2.06	.97	2.06	18.76	2.50	3.43	2.34	.39	.31	1.23	1.29	1.85
11	1.92	.97	1.29	34.2	1.78	1.78	2.06	.39	.31	1.71	1.53	1.71
12	2.34	.97	1.29	31.8	1.53	1.17	1.06	.39	.31	1.59	1.99	1.41
13	2.20	1.06	1.29	27.8	3.93	.86	.86	.39	.31	1.23	1.92	1.29
14	1.78	1.29	1.29	32.5	4.82	.86	.75	.39	.39	1.01	2.06	1.53
15	2.20	1.17	1.06	46.0	2.50	.75	.64	.39	.31	.86	1.78	13.45
16	3.93	1.06	.97	13.95	1.78	3.59	.64	.31	.31	.75	1.85	7.61
17	2.95	1.06	.97	7.61	1.53	3.27	.86	.31	.31	.75	2.20	3.59
18	2.95	1.17	1.06	5.00	2.06	1.78	.75	.31	.31	.75	[b]133.00	2.20
19	2.65	1.17	1.06	4.28	1.53	1.41	.75	.31	.31	.75	12.19	1.47
20	2.65	1.41	1.06	3.27	1.29	1.06	.64	.64	.31	10.40	7.19	1.29
21	83.40	55.8	1.06	2.95	1.06	1.06	.56	.64	.47	3.10	13.19	1.59
22	51.00	8.69	1.06	5.00	.86	.86	.47	.47	.47	1.85	7.82	1.71
23	70.70	4.28	.86	3.10	.86	.86	.39	.39	.86	1.47	5.38	1.47
24	17.20	6.97	.86	2.65	.75	.86	.39	.39	.64	1.23	4.45	1.29
25	4.28	8.25	.97	2.50	.86	.75	.39	.39	.47	4.64	3.27	1.23
26	2.65	4.64	4.64	2.06	.75	.75	.39	.31	.39	1.99	3.35	1.06
27	2.20	2.06	150.6	1.78	53.3	.64	.39	2.65	.47	1.47	4.45	1.06
28	1.78	1.41	13.45	1.53	6.15	.56	.39	.64	.39	1.99	6.05	1.17
29	1.06	.....	17.37	1.41	3.93	.86	.39	.47	.39	1.85	3.67	1.35
30	1.06	.....	31.7	2.06	2.95	1.41	.47	.39	1.29	1.48	3.51	2.80
31	1.78	.....	17.0	.....	1.65	.....	.47	.39	.....	1.53	.....	54.70

[a] Daily discharge does not include diversion from drainage basin of Graefenberg Creek.
[b] Approximate.

Monthly discharge of Starch Factory Creek near New Hartford, N. Y., for 1906.

[Drainage area, 3.4 square miles.]

Month.	Discharge in second-feet.			Corrected mean.[a]	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	83.4	1.06	9.46	10.23	3.01	3.47
February	55.8	.86	4.06	4.83	1.42	1.48
March	150.6	.86	8.86	9.63	2.83	3.26
April	46.0	1.41	10.85	11.62	3.42	3.82
May	53.3	.75	5.37	6.14	1.80	2.08
June	3.59	.56	1.35	2.12	.623	.70
July	2.80	.39	.95	1.72	.506	.58
August	2.65	.31	.50	1.27	.374	.43
September	1.29	.31	.41	.48	.141	.16
October	10.40	.43	1.93	2.60	.765	.88
November	133.00	.75	7.72	8.49	2.50	2.79
December	54.70	1.06	4.38	5.15	1.51	1.74
The year	150.6	.31	4.65	5.36	1.58	21.39

[a] Includes diversion from Graefenberg Creek.

SYLVAN GLEN CREEK NEAR NEW HARTFORD, N. Y.

The weir now used, which is located at the mouth of the stream, was erected in January, 1904, by the Consolidated Water Company, of Utica, N. Y., by whom the record is furnished. The conditions at the station and the bench marks are described in Water-Supply Paper No. 166, page 36, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Sylvan Glen Creek near New Hartford, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.06	0.86	0.21	3.13	0.31	0.31	0.38	0.04	0.04	0.46	0.71	1.34
2	.76	.56	.15	2.42	3.34	.24	.15	.04	.04	.27	.41	.86
3	.66	.34	.24	3.13	7.74	.18	.10	.10	.04	.12	.38	.71
4	1.16	.27	2.75	6.26	2.75	.15	.27	.10	.04	0	.32	.61
5	1.42	.24	.96	4.59	6.75	.15	.15	.08	.04	1.26	.31	.56
6	.96	.18	.76	4.80	2.09	.15	.05	.10	.02	.56	.29	2.67
7	.76	.18	.66	3.54	1.06	.18	.05	.05	0	1.92	.22	2.34
8	.66	.18	.56	2.59	.86	2.42	.05	.05	0	.31	.20	.81
9	.66	.21	.76	1.92	.86	.42	7.25	.04	0	.42	.16	.61
10	.46	.21	.56	10.20	.66	11.08	1.16	.04	0	.46	.29	.51
11	.42	.18	.42	9.32	.42	.56	.76	.05	0	.42	.61	.51
12	.76	.21	.38	6.26	.42	.31	.34	.04	0	.34	1.42	.40
13	.76	.21	.34	4.38	2.26	.18	.15	.04	0	.21	1.11	.34
14	.56	.21	.27	4.17	1.59	.12	.15	.04	0	.15	.91	.34
15	.56	.21	.24	9.32	.76	.10	.10	.04	0	.10	.86	6 75
16	1.42	.18	.24	2.59	.42	.42	.10	.04	0	.10	.86	3.14
17	1.16	.21	.18	1.92	.34	.46	.15	.04	0	.10	.81	1.82
18	1.16	.21	.18	1.26	.56	.42	.12	.02	0	.08	12.26	.91
19	.96	.18	.15	.96	.27	.27	.10	0	0	.08	4.17	56
20	.76	.27	.15	.96	.21	.15	.05	0	0	3.97	2.09	.40
21	11.08	10.20	.15	.76	.18	.21	.05	.05	0	.86	3.97	.51
22	11.67	2.42	.15	1.59	.12	.15	.05	.04	0	.42	2.42	.51
23	14.19	1.42	.12	.96	.10	.15	.05	.04	.10	.38	2.00	.40
24	6.75	2.09	.12	.66	.10	.12	.05	.04	.05	.34	1.34	.29
25	2.42	2.42	.10	.42	.10	.10	.05	.04	.04	1.76	1.16	.22
26	1.42	2.09	.12	.34	.10	.10	.04	.04	.04	.46	1.11	.21
27	.96	.76	23.94	.27	13.84	.05	.04	.27	.04	.34	1.50	.22
28	.76	.34	4.38	.27	1.76	.05	.05	.05	.02	.76	2.42	.24
29	.56	.....	1.92	.21	1.16	.10	.04	.04	0	.86	1.34	.24
30	.56	.....	6.75	.42	.66	.21	.04	.04	.10	.86	.91	.38
31	.96	.....	3.97	.....	.42	.....	.04	.04	.....	1.16	.....	17.69

NOTE.—August 19-20, September 7-22, September 29, and October 4 channel moist, no surface flow.

Monthly discharge of Sylvan Glen Creek near New Hartford, N. Y., for 1906.

[Drainage area, 1.18 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	14.19	0.42	2.21	1.87	2.16
February	10.20	.18	.97	.822	.86
March	23.94	.10	1.67	1.42	1.64
April	10.20	.21	2.99	2.53	2.82
May	13.84	.10	1.68	1.42	1.64
June	11.08	.05	.65	.551	.61
July	7.25	.04	.39	.330	.38
August	.27	0	.05	.042	.05
September	.10	0	.02	.017	.02
October	3.97	0	.63	.534	.62
November	12.26	.16	1.55	1.31	1.46
December	17.69	.21	1.53	1.30	1.50
The year	23.94	0	1.20	1.01	13.76

GRAEFENBERG CREEK NEAR NEW HARTFORD, N. Y.

A gaging weir was erected above the inflow to Graefenberg reservoir June 7, 1903, and a standard rain gage placed on the adjoining meadow slope, some distance from trees and structures. The record of flow is furnished by the Consolidated Water Company, of Utica, N. Y. The conditions at the station are described in Water-Supply Paper No. 166, page 37, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Graefenberg Creek near New Hartford, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.24	1.10	0.91	2.22	.....	1.38	1.49	1.10	1.05	1.00	1.05	1.81
2	1.19	1.00	.91	1.92	.....	1.38	1.29	1.00	1.05	1.00	1.05	1.33
3	1.19	.91	1.10	2.45	.....	1.38	1.29	1.14	1.10	1.00	1.00	1.29
4	1.49	.91	1.54	7.64	.....	1.38	1.54	1.14	1.00	1.00	1.00	1.29
5	1.33	.96	1.43	2.72	.....	1.38	1.33	1.10	1.00	2.04	1.00	1.19
6	1.19	.91	1.98	2.65	.....	1.43	1.29	1.10	1.00	1.38	1.00	10.66
7	1.14	.91	.91	2.27	.....	1.38	1.24	1.14	1.00	1.76	.96	1.76
8	1.19	.91	1.43	2.27	.....	2.10	1.19	1.14	1.00	1.14	.96	1.29
9	1.10	1.00	1.19	1.92	.....	1.49	1.81	1.10	1.00	1.38	1.00	1.29
10	1.00	.96	.96	3.06	.....	1.54	1.49	1.10	1.00	1.19	1.05	1.38
11	1.00	.91	.91	4.64	.....	1.43	1.29	1.10	1.00	1.33	1.10	1.29
12	1.19	.91	.91	4.26	.....	1.33	1.19	1.05	1.00	1.24	1.19	1.19
13	1.05	.96	.88	2.92	.....	1.29	1.19	1.05	1.00	1.10	1.19	1.10
14	1.00	1.00	.88	2.79	.....	1.29	1.14	1.10	1.00	1.05	1.19	1.05
15	1.05	.91	.85	4.72	.....	1.29	1.10	1.05	1.00	1.00	1.19	4.10
16	1.70	.91	.85	2.45	.....	1.76	1.10	1.05	1.00	1.00	1.19	1.81
17	1.33	.91	.85	2.04	.....	1.65	1.19	1.05	1.00	1.00	1.19	1.43
18	1.19	.91	.85	1.87	.....	1.60	1.19	1.05	1.00	1.00	4.41	1.24
19	1.14	.91	.88	1.81	.....	1.43	1.14	1.05	1.00	1.00	2.16	1.10
20	1.10	1.38	.91	1.70	.....	1.33	1.10	1.29	1.10	2.27	1.60	1.05
21	4.95	5.69	.91	1.65	.....	1.33	1.10	1.14	1.05	1.29	4.88	1.24
22	4.10	1.70	.91	1.92	.....	1.33	1.00	1.05	1.00	1.19	1.81	1.19
23	6.44	1.43	.91	1.70	.....	1.33	1.10	1.05	1.29	1.14	1.60	1.14
24	1.81	1.65	.91	1.60	.....	1.29	1.10	1.05	1.05	1.05	1.49	1.19
25	1.29	1.98	.96	1.54	.....	1.29	1.00	1.05	1.00	1.70	1.38	1.10
26	1.19	1.43	1.24	1.54	.....	1.24	1.10	1.05	1.00	1.05	1.38	1.14
27	1.10	1.19	12.61	1.49	.....	1.19	1.10	1.38	1.14	1.00	1.54	1.19
28	1.10	1.00	2.86	1.49	.....	1.24	1.10	1.14	1.00	1.05	1.70	1.19
29	1.00	.....	2.10	1.49	.....	1.29	1.10	1.10	1.00	1.10	1.33	1.24
30	1.05	.....	4.80	1.60	.....	1.33	1.10	1.10	1.19	1.10	1.29	1.65
31	1.10	.....	2.27	.....	.....	.....	1.10	1.06	.....	1.10	.....	7.84

Monthly discharge of Graefenberg Creek near New Hartford, N. Y., for 1906.

[Drainage area, 0.282 square mile.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	6.44	1.00	1.58	5.60	6.46
February	5.69	.91	1.26	4.47	4.66
March	12.61	.85	1.66	5.89	6.79
April	7.64	1.49	2.48	8.79	9.81
May	.....	.....	.....	.....	.....
June	2.10	1.19	1.40	4.96	5.53
July	1.81	1.00	1.21	4.29	4.95
August	1.29	1.00	1.10	3.90	4.50
September	1.29	1.00	1.03	3.65	4.07
October	2.27	1.00	1.21	4.29	4.95
November	4.88	.96	1.50	5.32	5.94
December	10.66	1.05	1.90	6.74	7.77

WEST CANADA CREEK AT TWIN ROCK BRIDGE, NEW YORK.

A current-meter gaging station was established September 7, 1900, at Twin Rock Bridge. The drainage area of the creek above Trenton Falls is 375 square miles. Gage heights taken by George Rood and furnished by the Utica Gas and Electric Company, were used to obtain the daily discharge September 12 to 29 and November 16 to December 31, 1906. For the remainder of the year gage readings taken once a day by Frank McArthur, who is in the employ of the Consolidated Water Company of Utica, were used. These latter readings are from a tape and weight gage, and are reduced to the datum of the board gage used by Mr. Rood. The conditions at the station and the bench marks are described in Water-Supply Paper No. 166, page 41, where are given also references to publications that contain data for previous years.

Discharge measurements of West Canada Creek at Twin Rock Bridge, New York, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 9-10	Horton and Mott	175	527	3.02	412
April 17	E. F. Weeks	168	1,310	6.80	5,540
April 23	do	167	1,330	6.90	5,570
September 19	do	149	256	.37	143
Do	C. C. Covert	157	253	.35	131
October 5	E. F. Weeks	152	313	.75	265
October 23	Barrows and Covert	159	460	1.61	479

[a] Measurement made under ice cover. Average ice thickness, 1.35 feet. Gage height to under surface of ice, 1.84 feet.

Daily gage height, in feet, of West Canada Creek at Twin Rock Bridge, New York, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.86	4.08	3.05	3.88	3.87	1.69	3.89	1.86	0.69	1.58	1.80	2.05
2	3.31	3.54	2.84	3.08	3.62	1.54	4.11	1.25	.61	.98	1.66	1.80
3	2.99	2.95	2.66	2.54	5.48	1.41	3.07	1.01	.58	.78	1.51	1.55
4	3.26	3.18	3.97	2.67	5.39	1.41	2.76	.87	.99	.69	1.41	1.65
5	3.99	3.44	4.34	3.81	4.32	1.20	3.06	3.00	.86	.68	1.55	1.50
6	4.06	3.09	4.05	3.66	3.96	1.21	2.31	2.03	.73	.71	1.20	2.10
7	3.69	3.14	3.65	2.90	2.92	1.83	1.86	1.58	.67	.93	1.11	1.00
8	3.52	3.11	3.23	2.70	2.27	1.75	1.57	1.22	.61	.75	.98	1.00
9	3.21	3.14	2.97	2.44	2.14	2.54	1.51	.90	.59	1.11	.85	1.50
10	3.17	3.05	3.08	2.26	2.42	2.01	2.30	.81	1.06	1.65	.91	1.60
11	3.17	2.99	2.37	2.18	2.46	2.51	2.92	.70	.49	2.01	.97	1.55
12	3.59	2.96	2.53	2.32	2.04	1.99	2.11	.72	.50	1.93	1.51	1.40
13	3.37	2.88	2.12	2.42	2.06	1.63	1.61	1.08	.50	1.65	1.22	1.35
14	3.43	2.95	2.05	2.94	5.35	1.43	1.32	.83	.50	1.46	2.22	1.60
15	3.75	2.83	1.91	7.89	3.82	1.24	1.19	.68	.50	1.50	1.87	1.75
16	3.69	2.68	1.90	8.95	2.69	1.24	1.01	.63	.50	1.07	1.00	2.85
17	3.71	2.70	1.90	7.29	2.01	1.40	1.01	.59	.50	1.16	.70	3.35
18	3.57	2.67	1.65	6.84	2.46	2.83	.99	.55	.50	.91	1.80	2.00
19	3.46	2.74	1.65	7.06	2.39	1.97	.92	.55	.45	.82	4.00	2.60
20	3.53	2.63	1.66	7.14	2.46	1.63	.95	.51	.45	1.87	5.00	2.50
21	3.54	2.70	1.84	7.41	1.93	1.41	.78	.78	.30	2.80	3.60	2.40
22	3.95	3.73	1.81	7.36	1.72	1.41	.49	1.58	.40	2.83	3.80	2.10
23	5.93	4.18	1.64	7.49	1.61	1.63	.75	1.04	2.15	1.87	2.85	2.00
24	10.45	3.93	1.67	5.15	1.53	2.06	.72	.75	1.35	1.45	3.30	2.05
25	7.95	3.85	1.66	3.44	1.80	1.82	.71	.67	.75	1.36	3.80	2.00
26	6.36	4.25	1.68	2.78	1.87	1.49	.66	1.27	.60	2.19	2.00	1.75
27	5.59	3.86	1.83	3.73	2.03	1.28	.62	1.21	.50	2.08	2.55	2.10
28	5.13	3.54	4.69	2.80	3.77	1.08	.64	2.32	.70	2.29	2.75	1.60
29	4.52	.....	4.57	3.81	3.22	.93	1.26	1.66	.80	2.33	3.00	1.55
30	4.07	.....	4.27	3.99	2.37	1.23	1.46	1.10	.....	2.06	2.25	1.70
31	4.37	.....	4.40	.....	1.89	.....	2.26	.79	.....	2.02	.....	1.90

Rating table for West Canada Creek at Twin Rock Bridge, New York, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.30	130	1.70	563	3.10	1,400	5.00	3,230
0.40	150	1.80	609	3.20	1,480	5.20	3,470
0.50	170	1.90	655	3.30	1,560	5.40	3,710
0.60	196	2.00	701	3.40	1,640	5.60	3,950
0.70	222	2.10	756	3.50	1,720	5.80	4,190
0.80	249	2.20	812	3.60	1,800	6.00	4,430
0.90	275	2.30	868	3.70	1,880	6.20	4,710
1.00	302	2.40	924	3.80	1,960	6.40	4,990
1.10	336	2.50	980	3.90	2,040	6.60	5,270
1.20	370	2.60	1,040	4.00	2,130	6.80	5,550
1.30	404	2.70	1,100	4.20	2,330	7.00	5,830
1.40	438	2.80	1,160	4.40	2,530	8.00	7,230
1.50	472	2.90	1,240	4.60	2,750	9.00	8,730
1.60	517	3.00	1,320	4.80	2,990	10.00	10,330

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905–6, and is well defined between gage heights 0.3 feet and 2.2 feet.

Monthly discharge of West Canada Creek at Twin Rock Bridge, New York, for 1906.

[Drainage area, 364 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April	8,660	801	2,980	8.19	9.14
May	3,810	485	1,340	3.68	4.24
June	1,180	283	549	1.51	1.68
July	2,240	168	636	1.75	2.02
August	1,320	173	372	1.02	1.18
September	781	130	232	.637	.71
October	1,180	217	529	1.45	1.67
November	3,230	222	890	2.45	2.73

NOTE.—Above values are rated as approximate.

WEST CANADA CREEK AT KAST BRIDGE, NEW YORK.

This station was established May 15, 1905. It is located on the bridge opposite the railway station at Kast Bridge, New York, about 4 miles along the stream above the mouth of the creek at Herkimer. The conditions and the bench marks are described in Water-Supply Paper No. 166, page 44, where are given also references to publications that contain data for previous years.

Discharge measurements of West Canada Creek at Kast Bridge, New York, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 5	D. L. Mott	196	745	30.58	2,870
September 18	E. F. Weeks	171	296	28.22	340
October 4	do	170	295	28.27	335
October 13	do	170	404	28.86	708
October 19	do	170	292	28.32	364
November 20	do	197	712	30.53	2,630
November 22	do	197	598	29.95	1,760

Daily gage height, in feet, of West Canada Creek at East Bridge, New York, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	29.85	29.42	29.22	30.38	30.62	28.92	30.62	28.92	28.32	28.45	28.99	29.39
2	29.52	29.08	29.10	30.05	30.40	28.70	30.65	28.68	27.90	28.55	28.74	28.87
3	29.35	28.70	28.92	29.85	31.70	28.58	29.95	28.50	27.48	28.42	28.63	28.80
4	29.48	28.52	30.48	30.12	30.70	28.52	29.50	28.72	28.30	28.38	28.62	28.43
5	30.00	28.90	30.05	30.75	31.02	28.52	29.80	29.62	28.88	28.46	28.56	28.72
6	29.85	28.75	29.75	30.60	30.60	28.72	29.38	29.18	28.18	28.42	28.56	29.27
7	29.40	28.85	29.60	30.15	30.25	28.82	29.02	29.00	28.18	28.66	28.48	29.40
8	29.28	28.88	29.35	29.95	29.68	28.98	28.80	28.62	28.18	28.88	28.45	28.79
9	29.05	28.92	29.38	29.88	29.70	29.42	29.02	28.42	28.12	28.66	28.41	28.88
10	29.10	28.95	29.50	29.55	29.72	29.32	29.62	28.45	27.92	28.80	28.48	28.85
11	29.05	28.88	28.95	30.05	29.60	29.35	29.75	28.20	28.12	29.30	28.63	28.84
12	29.22	28.90	29.00	30.38	29.35	29.18	29.28	28.25	28.10	29.10	28.92	28.70
13	29.18	28.98	28.72	30.20	29.30	28.82	28.95	28.12	27.65	28.88	28.83	28.75
14	29.02	28.88	28.78	30.55	30.60	28.70	28.70	28.68	27.90	28.72	28.86	28.78
15	29.02	28.85	28.55	33.68	30.58	28.58	28.60	28.38	27.98	28.56	29.27	29.89
16	29.10	28.88	28.72	33.38	29.80	28.68	28.52	28.12	28.08	28.56	28.74	30.30
17	29.12	28.90	28.78	32.45	29.45	29.08	28.60	28.12	27.90	28.42	28.62	30.25
18	29.05	28.82	28.62	32.08	29.55	29.92	28.52	27.98	28.20	28.40	29.08	29.75
19	29.08	28.80	28.60	32.18	29.40	29.22	28.45	28.00	28.05	28.34	30.47	29.30
20	29.00	28.78	28.55	32.30	29.60	28.80	28.35	27.90	27.95	29.90	30.48	29.15
21	29.25	29.82	28.55	32.35	29.20	28.72	28.22	28.60	28.12	29.80	29.94	29.20
22	30.78	30.45	28.60	32.40	28.92	28.70	28.28	28.50	28.18	29.76	30.00	29.10
23	32.45	30.05	28.50	32.40	28.85	28.90	28.30	28.52	26.58	29.18	30.32	28.95
24	33.12	29.88	28.50	31.40	28.80	29.10	28.28	28.40	28.85	28.74	29.72	28.70
25	31.85	30.00	28.60	30.48	28.85	29.08	28.18	28.20	28.58	28.95	29.57	28.61
26	30.92	30.30	28.70	29.95	28.95	28.75	28.18	28.05	28.35	29.12	29.29	28.72
27	30.05	29.62	30.70	30.45	29.75	28.58	28.05	28.22	28.35	29.12	29.58	28.78
28	29.65	29.30	31.48	29.93	30.48	28.58	28.30	28.15	28.28	29.18	29.92	28.76
29	29.50	.....	30.75	30.58	30.15	28.55	28.40	28.10	28.35	29.28	29.77	28.70
30	30.48	.....	30.75	30.50	29.55	28.62	28.45	28.52	28.42	29.23	29.38	28.67
31	29.45	.....	31.20	.....	29.08	.....	29.08	28.45	.....	29.30	.....	30.35

NOTE.—Ice conditions February 2 to 21; gage heights to water surface in hole in ice. No ice at gage during December; ice along shore above and below gage from 10 to 30 feet wide and 0.15 to 0.35 foot thick.

EAST CANADA CREEK AT DOLGEVILLE, N. Y.

Observations are taken at High Falls, near Dolgeville, about 7 miles from the outlet of the stream. The gaging station is located at the dam of the Herkimer County Light and Power Company.

Information in regard to this station is contained in the annual reports of the State engineer and surveyor of New York, and in Water-Supply Paper No. 166, page 45, where are given also references to publications that contain data for previous years

Daily discharge in second-feet of East Canada Creek at Dolgeville, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	260	484	a 280	1,000	951	471	1,070	468	92	213	997	492
2	433	214	210	962	1,140	409	1,010	172	63	142	759	365
3	423	209	159	850	2,680	383	851	191	240	160	179	112
4	312	a 250	742	817	2,180	340	619	145	124	153	165	294
5	348	290	517	1,400	1,600	265	745	83	132	110	192	a 294
6	288	b 208	517	1,310	1,380	288	402	358	136	95	170	a 700
7	105	b 275	a 369	1,090	a 1,103	234	378	351	95	383	175	700
8	218	224	221	795	826	366	491	176	100	284	180	300
9	263	252	316	715	893	420	584	163	85	154	170	265
10	b 218	219	138	380	1,010	406	565	162	123	279	200	458
11	b 221	a 240	a 176	869	938	456	519	176	90	370	171	b 184
12	326	261	214	830	816	392	419	114	95	434	281	b 214
13	230	b 238	230	1,130	748	259	272	121	95	384	244	363
14	142	b 224	214	2,020	675	208	326	121	100	285	238	299
15	218	255	213	5,760	768	158	328	108	85	195	203	838
16	195	192	224	4,800	739	175	205	112	85	170	170	b 548
17	200	110	148	4,170	606	330	190	74	95	127	156	b 518
18	200	a 147	115	3,460	545	508	200	82	90	120	149	623
19	185	185	193	3,710	452	270	185	61	85	183	769	521
20	175	191	209	3,620	540	248	144	165	80	954	977	794
21	102	319	184	3,230	470	231	130	175	105	580	914	805
22	714	434	189	3,620	370	250	80	195	100	404	1,150	444
23	2,380	376	193	2,910	394	258	158	134	309	826	982	377
24	2,870	260	157	2,100	366	220	148	129	123	167	693	205
25	1,500	341	174	1,670	356	395	160	105	105	175	576	105
26	1,230	432	179	1,390	330	209	155	85	105	551	481	300
27	1,050	422	171	1,210	a 950	459	128	305	105	279	476	270
28	842	a 351	1,230	1,040	1,570	609	150	459	181	461	691	345
29	780	.....	1,290	864	826	238	245	204	146	403	658	299
30	550	.....	1,080	950	1,050	227	409	63	207	429	617	367
31	501	.....	1,430	.....	640	.....	604	200	.....	468	.....	330

a Record incomplete; values interpolated. b Crest of dam obstructed by ice.

NOTE.—Ice went out of dam April 5 to 6.

Monthly discharge at East Canada Creek at Dolgeville, N. Y., for 1906.

[Drainage area, 256 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	2,870	102	564	2.20	2.54
February	484	110	272	1.06	1.10
March	1,430	115	377	1.47	1.70
April	5,760	380	1,960	7.66	8.55
May	2,680	330	900	3.52	4.06
June	609	158	323	1.26	1.41
July	1,070	80	384	1.50	1.73
August	468	61	176	.688	.79
September	309	63	119	.465	.52
October	954	95	321	1.25	1.44
November	1,150	149	459	1.79	2.09
December	838	105	411	1.61	1.86
The year	5,760	61	522	2.04	27.70

NOTE.—Values April to November, good; January to March, fair; December, fair.

SCHOHARIE CREEK AT PRATTSVILLE, N. Y.

This station was established November 7, 1902, at the highway bridge in the village of Prattsville. During 1906 the gage was read twice each day by Edna M. Snyder. The conditions at the station and the bench marks are described in Water-Supply Paper No. 166, page 47, where are given also references to publications that contain data for previous years.

Discharge measurements of Schoharie Creek at Prattsville, N. Y., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec. ft.*
August 25	C. C. Covert	62.5	16	4.25	[a] 41
November 3	do	180	183	4.62	137

[a] Made by wading one-fourth mile below bridge.

Daily gage height, in feet, of Schoharie Creek at Prattsville, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.95	4.95	5.27	5.52	5.07	5.61	4.95	4.30	4.30	4.22	4.70	4.92
2	5.00	4.90	5.27	5.37	5.01	5.46	4.70	4.35	4.30	4.20	4.60	4.90
3	5.10	4.80	5.17	5.27	4.96	5.21	4.85	4.30	4.30	4.20	4.60	5.00
4	5.20	4.80	7.85	5.37	4.96	5.08	4.95	4.30	4.30	4.20	4.60	5.00
5	5.25	4.70	5.85	6.25	4.96	5.01	4.82	4.40	4.25	4.20	4.55	5.10
6	5.05	4.70	5.37	6.62	4.91	5.31	4.65	4.40	4.20	4.20	4.50	5.55
7	5.25	4.70	5.29	5.92	5.38	5.08	4.60	4.75	4.18	4.20	4.50	5.50
8	5.45	4.72	5.22	5.72	5.41	4.94	4.52	4.90	4.18	4.20	4.50	5.10
9	5.40	4.72	5.17	5.59	5.56	5.02	4.52	4.55	4.15	4.20	4.45	5.52
10	5.38	4.80	5.17	7.67	5.38	5.25	4.52	4.45	4.15	4.28	4.45	5.60
11	5.45	4.80	5.27	7.12	5.24	5.35	4.52	4.40	4.15	4.30	4.50	5.75
12	5.60	4.80	5.27	6.22	5.16	5.05	4.45	4.32	4.15	4.30	4.58	5.60
13	5.50	4.80	5.27	6.42	5.11	4.85	4.40	4.25	4.15	4.30	4.55	5.40
14	5.50	4.90	5.27	9.57	5.06	4.85	4.38	4.25	4.18	4.22	4.55	5.40
15	5.40	4.90	5.27	7.52	5.01	4.75	4.32	4.22	4.10	4.20	4.55	5.30
16	5.40	4.90	5.27	6.87	4.96	4.82	4.30	4.20	4.10	4.20	4.75	5.30
17	5.25	4.95	5.07	6.72	4.91	5.45	4.35	4.22	4.05	4.20	4.65	5.15
18	5.10	5.00	4.77	6.42	4.86	5.50	4.42	4.20	4.08	4.20	5.68	5.10
19	5.00	4.97	4.77	6.27	4.88	5.60	4.30	4.20	4.05	4.20	7.08	5.20
20	4.95	4.92	4.82	6.17	4.84	5.42	4.35	4.12	4.08	5.68	6.22	5.10
21	5.15	4.95	4.99	6.02	4.76	5.15	4.28	4.40	4.18	5.32	6.10	5.40
22	5.38	5.99	5.02	5.82	4.78	5.18	4.25	4.45	4.40	5.18	5.95	5.20
23	5.70	6.15	5.02	5.72	4.74	5.18	4.32	4.40	4.45	4.95	5.75	5.10
24	7.05	5.37	4.99	5.57	4.71	5.08	4.35	4.30	4.32	4.80	5.45	5.10
25	5.65	5.47	4.87	5.47	4.66	4.88	4.28	4.20	4.22	6.10	5.30	5.00
26	5.40	5.97	4.87	5.37	4.71	4.78	4.22	4.20	4.20	5.50	5.18	5.00
27	5.35	5.87	8.50	5.27	6.14	4.70	4.28	4.90	4.18	5.05	5.12	5.00
28	5.20	5.39	7.32	5.17	8.16	4.62	4.28	5.10	4.20	5.00	5.10	4.90
29	5.12	.....	5.79	5.07	7.51	4.60	4.32	4.95	4.20	4.90	5.00	4.90
30	5.08	.....	5.69	5.07	6.31	4.48	4.30	4.50	4.28	4.80	5.00	5.00
31	5.00	.....	5.67	.....	5.84	.....	4.30	4.38	.....	4.72	.....	5.70

NOTE.—Ice conditions January 7-21, February 3-22, February 28-March 3, and March 20-26. Ice 0.1 to 0.5 foot thick. River frozen over from December 4 to 31. Ice from 0.30 to 0.75 foot thick. The following comparative readings were taken:

Comparative ice and water readings.

Date.	Thickness of ice at gage.	Gage reading to water surface.	Gage reading to top of ice.
	Feet.	*Feet.*	*Feet.*
December 19	0.38	5.1	5.2
December 22	.25	5.1	5.2
December 26	.83	4.9	5.0
December 29	.75	4.9	4.9

December 31 ice went out of river at station. During frozen period for January, February, and March the readings were taken to the water surface through a hole cut in the ice.

Gage readings for frozen period during December were to top of ice, with readings to water surface through a hole cut in the ice on Wednesday and Saturday of each week.

Rating table for Schoharie Creek at Prattsville, N. Y., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.05	14	5.10	345	6.20	1,170	7.60	2,990
4.10	18	5.20	405	6.30	1,270	7.80	3,300
4.20	28	5.30	465	6.40	1,370	8.00	3,620
4.30	42	5.40	525	6.50	1,470	8.20	3,960
4.40	61	5.50	585	6.60	1,600	8.40	4,300
4.50	85	5.60	663	6.70	1,720	8.60	4,640
4.60	125	5.70	741	6.80	1,850	8.80	4,980
4.70	165	5.80	819	6.90	1,970	9.00	5,320
4.80	205	5.90	897	7.00	2,100	9.20	5,680
4.90	245	6.00	975	7.20	2,390	9.40	6,040
5.00	285	6.10	1,070	7.40	2,680	9.60	6,400

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-1906, and is well defined between gage heights 4.1 feet and 8.0 feet.

Monthly discharge of Schoharie Creek at Prattsville, N. Y., for 1906.

[Drainage area, 240 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April	6,350	327	1,250	5.21	5.81
May	3,890	149	578	2.41	2.78
June	671	80	350	1.46	1.63
July	265	31	87.5	.365	.42
August	345	20	82.0	.342	.39
September	73	14	30.0	.125	.14
October	1,070	28	178	.742	.86
November	2,230	73	384	1.60	1.78

NOTE.—Values are rated as follows: September, good; April to August and October to November, excellent.

KINDERHOOK CREEK AT ROSSMAN, N. Y.

Kinderhook Creek is an interstate stream, having its source in the Hancock Mountains, Massachusetts. It flows southwesterly through Columbia and Rensselaer counties, N. Y., and joins Claverack Creek about 2 miles from the Hudson River, forming Stockport Creek, through which it discharges its water into the Hudson, 4 miles north of the village of Hudson.

The topography of the basin is shown on the Troy, Berlin, Pittsfield, Kinderhook, and Coxsackie sheets of the United States Geological Survey topographic atlas, from which the following drainage areas have been determined:

Drainage areas of Kinderhook Creek.

Point of measurement.	Area.	Total area.
	Sq. miles.	*Sq. miles.*
Kinderhook Creek above Garfield	39.3	39.3
Kinderhook Creek from Garfield to Wyomanock Creek	34.8	74.1
Wyomanock Creek above mouth	31.3	105.4
Kinderhook Creek from Wyomanock Creek Junction to Valatie Kill	167.2	272.6
Valatie Kill above Kinderhook Lake	37.6	.....
Kinderhook Lake	2.7	.....
Valatie Kill from Kinderhook Lake to mouth	3.9	.....
Valatie Kill above mouth	44.2	316.8
Kinderhook Creek from Valatie Kill to gaging station at Rossman	14.3	331.1
Kinderhook Creek from gaging station to Claverack Creek	6.4	337.5

The gaging station was established March 17, 1906, at the highway bridge near Rossman post-office, about 7 miles northeast of Hudson, Columbia County, N. Y., on the line of the Albany and Hudson Electric Railroad, and about one-eighth mile below Chittenden Falls and the dam of the Rossman Paper and Woven Wire Fence Mills.

A box gage of the tape and weight type is located on the upstream side of the highway bridge, 50 feet from the right-hand end; length of tape and weight, 50 feet. The gage is read morning, noon, and night by Wesley Ham. The bench mark is a ½-inch bolt painted white, driven in the downstream side of a large elm tree about 30 feet from the right-hand abutment, downstream side of bridge: elevation, 47.65 feet above zero of gage.

Information in regard to this creek is published in Supplement to New York State Engineer's Report, 1902, pages 252–256.

Discharge measurements of Kinderhook Creek at Rossman, N. Y., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 16[a]	Covert and Weeks	137	149	27.05	262
March 17[b]	do	148	206	27.35	120
August 2	C. C. Covert	133	123	26.90	188
August 22[c]	do	130	195	26.67	124
October 28[b]	E. F. Weeks	147	170	27.25	319
November 2	C. C. Covert	147	187	27.29	318

[a] Some obstruction by ice. [b] Upstream side of bridge. [c] Wading about 100 feet below bridge.

Daily gage height, in feet, of Kinderhook Creek at Rossman, N. Y., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		28.26	27.63	27.66	27.52	27.04	26.74	26.72	27.26	27.31
2		28.11	27.42	27.57	27.60	27.06	26.68	26.72	27.28	27.22
3		27.96	27.72	27.37	27.65	27.00	26.66	26.71	27.23	27.18
4		27.87	27.57	27.27	27.49	26.97	26.69	26.74	27.05	27.12
5		28.10	27.62	27.25	27.52	27.00	26.80	26.72	26.93	27.09
6		28.48	27.53	28.29	27.38	26.92	26.73	26.62	26.94	27.02
7		28.38	27.51	28.21	27.20	27.33	26.73	26.64	26.91	27.88
8		28.09	27.48	27.84	27.08	27.30	26.65	26.51	26.92	27.77
9		28.09	27.48	27.74	27.06	27.33	26.56	26.66	26.93	27.73
10		28.82	28.20	27.60	27.02	26.93	26.71	26.66	26.83	27.68
11		29.59	27.76	27.77	26.97	26.98	26.72	26.70	26.78	27.64
12		29.17	27.60	27.59	26.85	26.82	26.68	26.73	27.29	27.47
13		28.87	27.57	27.48	26.76	26.78	26.59	26.92	27.32	27.42
14		28.52	27.49	27.22	26.76	26.76	26.49	26.82	27.28	27.48
15		30.01	27.41	27.22	26.82	26.77	26.51	26.83	27.21	27.42
16		30.63	27.32	27.22	26.70	26.72	26.44	26.82	27.24	27.40
17	27.37	29.57	27.81	27.28	26.70	26.72	26.60	26.71	27.21	27.41
18	27.33	29.01	27.42	27.28	26.72	26.70	26.52	26.73	27.17	27.42
19	27.29	28.56	27.37	27.20	26.82	26.74	26.51	26.71	28.39	27.07
20	27.29	28.41	27.23	27.16	26.75	26.51	26.52	27.20	28.24	26.97
21	27.27	28.21	27.24	27.01	26.72	26.57	26.51	28.06	28.15	26.93
22	27.28	28.10	27.24	27.15	26.50	26.58	26.52	27.79	28.10	27.11
23	27.11	28.05	27.24	26.95	26.77	26.57	26.52	27.55	27.93	27.20
24	27.03	28.20	27.24	26.68	26.71	26.57	26.69	27.34	27.78	27.03
25	27.01	28.01	27.09	26.86	26.73	26.59	26.74	27.34	27.61	27.12
26	27.12	27.87	27.07	26.89	26.78	26.70	26.72	27.32	27.48	27.04
27	28.96	27.72	26.80	26.81	26.73	26.59	26.63	27.33	27.40	27.06
28	30.01	27.69	28.39	26.79	26.67	26.80	26.67	27.20	27.42	27.05
29	28.92	27.52	28.84	26.72	26.66	26.79	26.70	27.11	27.42	27.12
30	28.56	27.54	28.31	26.72	26.72	26.80	26.50	27.22	27.34	27.13
31	28.57	.....	27.93	.....	26.84	26.80	.....	27.28	.....	28.97

NOTE.—Station is about one-fourth mile below a dam. Very little obstruction from ice, except in extreme cold weather.

CATSKILL CREEK AT SOUTH CAIRO, N. Y.

The gaging station was established July 4, 1901, at the highway bridge in village of South Cairo. The conditions and the bench marks are described in Water-Supply Paper No. 166, page 49, where are given also references to publications that contain data for previous years.

Discharge measurements of Catskill Creek at South Cairo, N. Y., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 16[a]	Horton and Mott	100	190	2.82	62
June 7	C. C. Covert	160	317	3.35	267
August 21[b]	do	58	47	2.25	36
September 9[c]	do	20	14	2.10	15.4
Do.[c]	do	21	13	2.09	13.9

[a] Measurement made under ice cover, average thickness of ice 0.70 feet. Gage height to bottom of ice 2.22 feet.
[b] Made by wading 1,000 feet above bridge.
[c] Made by wading one-fourth mile below bridge.

Daily gage height, in feet, of Catskill Creek at South Cairo, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.12	3.05	4.61	4.46	3.15	3.84	4.60	2.20	2.10	2.02	2.42	3.20
2	3.05	3.05	4.29	4.21	3.00	3.49	3.70	2.12	2.12	1.95	2.18	3.10
3	3.25	2.90	4.12	4.16	3.55	3.32	4.60	2.10	2.00	1.95	2.10	3.10
4	3.40	3.00	8.52	4.21	3.45	3.19	4.20	2.10	2.05	1.95	2.20	3.20
5	3.50	3.00	5.37	5.58	3.25	3.12	3.40	2.10	1.90	2.25	2.32	3.18
6	3.15	2.98	3.97	5.98	3.15	3.14	2.78	2.18	2.08	2.25	2.30	3.30
7	3.22	2.80	3.67	4.86	3.15	3.27	2.85	2.20	2.02	2.15	2.25	4.75
8	3.30	2.70	3.62	4.46	3.04	3.12	2.60	2.20	2.05	2.00	2.35	4.08
9	3.31	2.70	3.92	4.71	2.95	2.98	2.72	2.55	2.05	2.00	2.85	4.00
10	3.00	2.70	4.07	6.16	3.15	3.15	2.70	2.45	1.98	2.02	2.35	4.05
11	3.00	2.80	3.57	7.34	3.05	3.30	2.72	2.22	1.95	2.05	2.35	4.05
12	2.90	2.80	3.52	6.41	2.95	3.00	2.55	2.05	2.10	2.05	2.35	3.35
13	3.25	2.80	3.32	5.66	2.85	3.65	2.45	2.30	1.90	2.02	2.50	2.85
14	2.95	2.75	3.07	5.74	2.75	2.60	2.40	2.20	2.00	2.05	2.40	2.85
15	2.82	2.80	3.27	7.91	2.75	2.57	2.52	2.10	1.95	2.05	2.45	3.10
16	2.85	2.80	3.27	6.36	2.67	2.55	2.20	2.10	2.00	1.98	2.40	3.85
17	3.25	2.78	3.07	5.31	2.60	3.88	2.45	2.10	2.00	1.95	2.48	3.50
18	3.20	2.80	2.87	4.86	2.63	4.05	2.60	2.10	1.95	2.02	2.75	3.18
19	2.95	2.78	2.95	4.58	2.70	3.70	2.42	2.00	1.95	2.05	5.45	2.95
20	2.90	2.75	3.67	4.51	2.60	3.52	2.25	1.95	1.95	2.32	4.80	3.05
21	2.88	2.88	3.17	4.11	2.45	3.20	2.32	2.10	1.95	2.80	4.55	3.20
22	3.75	5.10	3.02	3.98	2.64	3.25	2.10	1.90	2.05	2.55	4.55	3.50
23	4.20	4.20	2.97	3.81	2.37	2.95	2.22	2.25	2.00	2.52	4.18	3.40
24	5.15	4.07	2.89	3.68	2.39	2.95	2.30	2.20	2.05	2.35	3.75	3.00
25	4.00	4.12	2.82	3.50	2.54	2.85	2.18	2.10	2.05	2.65	3.40	3.20
26	3.60	4.92	6.11	3.35	2.56	2.72	2.12	2.20	2.00	2.55	3.42	3.20
27	3.42	4.02	8.91	3.27	4.19	2.35	2.15	2.25	2.00	2.48	3.40	3.10
28	3.32	3.97	9.21	3.17	7.54	2.38	2.00	2.08	1.95	2.45	3.50	2.70
29	3.30	.....	6.34	3.06	6.49	2.45	2.00	2.35	2.05	2.45	3.42	2.80
30	3.18	.....	4.86	3.05	4.79	2.40	2.10	2.10	1.98	2.45	3.18	2.80
31	3.10	.....	5.61	.....	4.34	.....	2.18	2.10	.....	2.42	.....	3.15

NOTE.—Creek frozen over January 2 to February 22; ice thickness varied from 0.2 to 0.8 foot. Readings for this period are to water surface in hole cut in ice.

During the frozen period of December regular readings are to the top of the ice.

ESOPUS CREEK AT KINGSTON, N. Y.

This station was established July 5, 1901, at the Washington Street Bridge over Esopus Creek at Kingston. The conditions and the bench

marks are described in Water-Supply Paper No. 166, page 52, where are given also references to publications that contain data for previous years.

Discharge measurements of Esopus Creek at Kingston, N. Y., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 15[a]	Horton and Mott	90	287	5.60	250
August 23	C. U. Covert	87	224	4.50	151

[a] Measurement made under ice cover. Average thickness of ice 0.33 foot. Gage height to bottom of ice 5.17 feet.

Daily gage height, in feet, of Esopus Creek at Kingston, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.40	6.12	6.50	8.32	6.24	7.18	5.58	4.75	4.25	4.25	5.72	5.60
2	6.12	6.05	6.47	7.99	6.11	6.82	5.65	4.52	4.04	4.08	5.52	5.50
3	5.92	5.89	6.23	7.42	6.28	6.60	5.75	4.48	4.04	4.05	5.32	5.42
4	7.05	5.42	14.55	7.28	6.20	6.16	7.25	5.05	4.28	3.98	5.18	5.25
5	7.52	5.99	9.65	7.75	6.20	5.98	5.94	5.12	4.12	3.98	5.18	5.12
6	6.90	5.59	8.27	8.63	6.04	6.10	5.66	5.70	4.12	3.98	5.05	5.62
7	6.47	5.75	7.80	8.25	6.04	5.92	5.42	5.18	4.12	3.98	4.98	6.88
8	7.20	5.75	7.39	7.85	6.00	5.68	5.12	5.50	4.02	3.88	4.88	5.84
9	7.36	5.67	7.21	7.61	6.22	5.58	5.04	5.21	3.94	4.12	4.62	5.62
10	6.55	5.62	7.00	9.33	6.69	6.10	5.35	4.75	3.78	4.02	4.85	5.92
11	6.42	5.59	6.55	11.48	6.49	5.88	5.28	4.78	4.02	4.08	4.92	6.12
12	6.72	5.56	6.57	10.67	6.27	5.68	5.05	4.75	3.92	4.08	5.88	6.00
13	7.05	5.60	6.13	9.92	6.16	5.52	4.88	4.58	3.92	4.00	5.55	5.70
14	6.42	5.60	6.17	9.55	6.11	5.34	4.80	4.48	3.98	3.92	5.30	5.68
15	6.11	5.55	6.65	16.01	5.91	5.28	4.68	4.40	3.95	3.85	5.15	5.62
16	6.21	5.36	7.41	13.75	5.86	5.92	4.62	4.38	3.94	3.86	5.20	6.53
17	6.20	5.56	6.73	11.21	5.76	7.50	4.66	4.25	3.82	3.80	5.08	6.00
18	6.10	5.22	5.97	9.85	5.65	7.42	4.84	4.22	3.95	3.75	5.08	5.99
19	5.88	5.38	6.16	9.33	5.63	8.92	4.70	4.20	3.95	3.72	7.92	5.60
20	5.70	5.41	6.46	8.93	5.51	8.85	4.52	4.15	3.95	6.88	8.02	5.35
21	5.60	5.58	6.14	8.45	5.46	7.88	4.72	4.68	4.05	7.00	7.62	6.92
22	5.85	9.21	5.54	8.05	5.36	8.52	4.75	4.98	4.32	6.25	7.00	6.52
23	7.08	7.94	5.49	7.92	5.25	7.92	4.60	4.60	5.08	5.82	7.25	5.90
24	9.55	7.36	5.44	7.80	5.23	7.59	4.68	4.55	4.52	5.60	6.68	5.35
25	8.66	7.26	5.32	7.32	5.66	7.10	4.44	4.38	4.35	8.06	6.52	5.10
26	7.92	8.21	5.29	7.04	5.39	6.61	4.44	4.55	4.18	8.45	6.38	5.88
27	7.47	7.41	5.79	6.80	5.33	6.25	4.38	4.20	4.10	7.32	6.18	5.66
28	7.07	6.84	9.09	6.62	9.25	6.05	4.28	4.62	4.00	6.72	5.95	5.69
29	6.77	.....	8.36	6.34	9.30	5.85	4.28	4.38	4.05	6.40	5.78	5.60
30	6.55	.....	8.29	6.30	9.38	5.60	4.36	4.32	4.15	6.08	5.70	5.75
31	6.45	.....	9.04	.....	7.74	.....	4.80	4.22	.....	5.82	.....	8.42

NOTE.—Ice conditions January 8-19, February 3 to March 3, March 16-26. Ice thickness varied from 0.1 to 0.5 foot. Slight ice gorging at times. Also ice conditions December 9 to 31. No ice at gage, but ice 0.1 to 0.7 foot thick above and below bridge. Ice broke up December 31. During frozen period readings were to water surface in hole cut in ice.

Rating tables for Esopus Creek at Kingston, N. Y.

OPEN-CHANNEL CONDITIONS, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.70	36	5.10	285	6.50	700	8.80	1,820
3.80	49	5.20	309	6.60	741	9.00	1,940
3.90	63	5.30	334	6.70	782	9.20	2,074
4.00	77	5.40	358	6.80	823	9.40	2,208
4.10	94	5.50	383	6.90	864	9.60	2,348
4.20	110	5.60	412	7.00	905	9.80	2,495
4.30	127	5.70	441	7.20	995	10.00	2,642
4.40	143	5.80	469	7.40	1,085	11.00	3,440
4.50	160	5.90	498	7.60	1,179	12.00	4,340
4.60	180	6.00	527	7.80	1,276	13.00	5,305
4.70	200	6.10	562	8.00	1,373	14.00	6,280
4.80	220	6.20	596	8.20	1,480	15.00	7,310
4.90	240	6.30	631	8.40	1,587	16.00	8,390
5.00	260	6.40	665	8.60	1,700		

[a] The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1901-1906 and is well defined between gage heights 3.8 feet and 11.0 feet. The extension is based on 2 measurements above 11.0 feet.

ICE PERIOD, 1906.

5.10	217	5.90	387	6.70	608	8.00	1,142
5.20	237	6.00	410	6.80	641	8.20	1,245
5.30	257	6.10	436	6.90	674	8.40	1,348
5.40	277	6.20	463	7.00	707	8.60	1,456
5.50	297	6.30	489	7.20	787	8.80	1,568
5.60	320	6.40	516	7.40	868	9.00	1,680
5.70	342	6.50	542	7.60	955		
5.80	365	6.60	575	7.80	1,048		

Monthly discharge of Esopus Creek at Kingston, N. Y., for 1906.

[Drainage area, 324 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	2,310	383	776	2.40	2.77
February	1,800	241	517	1.60	1.67
March	6,840	255	1,040	3.21	3.70
April	8,410	631	2,040	6.30	7.03
May	2,190	316	687	2.12	2.44
June	1,890	329	793	2.45	2.73
July	1,020	124	276	.852	.98
August	441	102	194	.599	.69
September	280	46	94.7	.292	.33
October	1,610	39	361	1.11	1.28
November	1,380	184	528	1.63	1.82
December	1,600	217	436	1.35	1.56
The year	8,410	39	645	1.99	27.00

NOTE.—Values are rated as follows: January, March, and December, fair; February, approximate; April to July, October and November, excellent; August and September, good.

ESOPUS CREEK NEAR OLIVE BRIDGE, N. Y.

During 1906 a weir for the purpose of measuring the flow of the Esopus Creek has been constructed near Olive Bridge, N. Y., by the board of water supply of the city of New York. It is located about 1 mile below the Olive Bridge post-office. The following description and discharge data have been furnished by Mr. J. Waldo Smith, chief engineer.

The weir is constructed of concrete, having a cross section similar to that experimented on in the hydraulic laboratory at Cornell University by the United States Geological Survey, in Series 30, described in Water-Supply and Irrigation Paper No. 150.

The average height of this weir above the rock on which it is founded, for its entire length, is 7.54 feet; length between abutments, 193.90 feet. In order to form a channel of approach the abutments have been extended upstream at right angles with the axis of the weir for a distance of 16 feet, and the area of the channel of approach below the crest of the weir is 1,462 square feet. The abutments extend 14 feet above the level of the crest, and it is estimated that a flow of 40,000 cubic feet per second can be taken care of.

Measurements of the head on the weir are made in a well 24 inches in diameter, situated 53 feet upstream from the crest of the weir. Water is admitted to this well through a ¾-inch pipe extending 16 feet out into the stream in which, spaced 6 inches apart, are ⅛-inch holes bored vertically through the pipe. The center of this pipe is placed 18 inches above the bed of the stream. A continuous record of the head at this point is kept by means of a Friez automatic water-stage register, geared 1 to 1 and running twenty-four hours. Observations of the flow were first begun on October 17, 1906, though the automatic gage register was not installed until December 5. Prior to this latter date heads were read three times daily and reduced in the usual manner.

Computations of the discharge over this weir are made from a formula which has been deduced from the results of the experiments made by the United States Geological Survey and referred to above. During the winter the ice which forms between the wing walls which form the channel of approach is kept cut away so that there may be no change in the conditions of flow due to this cause.

The watershed of Esopus Creek above the weir is 239 square miles, as measured on the topographic maps of the United States Geological Survey.

Daily discharge, in second-feet, of Esopus Creek near Olive Bridge, N. Y., for 1906.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1		196	295	17		1,155	372
2		176	280	18		1,397	388
3		155	277	19	42	1,207	242
4		142	331	20	663	916	284
5		133	311	21	199	940	535
6		121	458	22	105	972	476
7		103	507	23	102	871	373
8		98	216	24	77	760	209
9		73	314	25	1,430	676	248
10		57	368	26	630	565	276
11		62	396	27	534	472	299
12		91	331	28	420	410	291
13		144	320	29	323	356	283
14		137	306	30	268	304	319
15		302	370	31	226		2,004
16		655	417				

Monthly discharge of Esopus Creek near Olive Bridge, N. Y., for 1906.

[Drainage area, 239 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
October 19-31	1,430	42	386	1.62	0.78
November	1,400	57	455	1.90	2.12
December	2,000	209	390	1.63	1.88

WAPPINGER CREEK NEAR WAPPINGER FALLS, N. Y.

This station was established May 19, 1903, at the first highway bridge crossing Wappinger Creek above the village of Wappinger Falls. It was discontinued July 1, 1905, but the rating tables and estimates of monthly discharge heretofore unpublished are given in the following tables. The conditions at the station and the bench marks are described in Water-Supply Paper No. 166, page 55, where are given also references to publications that contain data for previous years.

Rating tables for Wappinger Creek, near Wappinger Falls, N. Y.

MAY 19, 1903, TO AUGUST 31, 1903.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.30	30	1.50	260	2.70	629	3.90	1,098
0.40	40	1.60	286	2.80	665	4.00	1,140
0.50	52	1.70	313	2.90	702	4.20	1,226
0.60	66	1.80	341	3.00	740	4.40	1,315
0.70	82	1.90	370	3.10	778	4.60	1,407
0.80	100	2.00	400	3.20	816	4.80	1,502
0.90	120	2.10	430	3.30	855	5.00	1,600
1.00	142	2.20	461	3.40	894	5.20	1,700
1.10	165	2.30	493	3.50	934	5.40	1,802
1.20	188	2.40	526	3.60	974	5.60	1,906
1.30	211	2.50	560	3.70	1,015	5.70	1,959
1.40	235	2.60	594	3.80	1,056		

[a] This table is based on 6 discharge measurements made during 1903 and is well defined between gage heights 0.6 foot and 5.0 feet.

SEPTEMBER 1, 1903, TO JUNE 30, 1905.[b]

−0.30	10	1.00	181	2.30	537	4.20	1,287
−0.20	16	1.10	202	2.40	571	4.40	1,375
−0.10	23	1.20	224	2.50	606	4.60	1,465
0.00	31	1.30	247	2.60	641	4.80	1,557
0.10	40	1.40	271	2.70	677	5.00	1,650
0.20	51	1.50	296	2.80	714	5.20	1,744
0.30	63	1.60	323	2.90	752	5.40	1,840
0.40	76	1.70	351	3.00	790	5.60	1,937
0.50	90	1.80	380	3.20	868	5.80	2,035
0.60	105	1.90	410	3.40	948	6.00	2,135
0.70	122	2.00	441	3.60	1,030	7.00	2,644
0.80	141	2.10	472	3.80	1,114	8.00	3,174
0.90	161	2.20	504	4.00	1,200	9.00	3,724

[b] This table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1903 to 1905 and on the form of the preceding curve. It is well defined between gage heights 0.15 foot and 3.0 feet.

Monthly discharge of Wappinger Creek near Wappinger Falls, N. Y., for 1903–1905.

[Drainage area, 194 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean	Sec.-ft. per sq. mile.	Depth in inches.
1903.					
May 19 to 31	200	35	75.9	0.391	0.19
June	1,960	75	653	3.37	3.76
July	856	91	267	1.38	1.59
August	1,150	120	345	1.78	2.05
September	771	122	276	1.42	1.58
October	3,040	114	633	3.26	3.76
November	696	181	282	1.45	1.62
1904.					
March 8 to 31	3,500	284	977	5.04	4.50
April	868	192	424	2.19	2.44
May	771	151	248	1.28	1.48
June	1,530	90	302	1.56	1.74
July	501	70	124	.665	.77
August	161	13	52.7	.272	.31
September	790	23	167	.861	.96
October	771	93	209	1.08	1.24
November	247	105	162	.835	.93
December 1 to 7 and 28 to 31	1,380	181	560	2.89	1.18
1905.					
January	2,140	472	893	4.60	5.30
March 10 to 31	2,780	435	1,420	7.32	6.99
April	908	181	468	2.41	2.69
May	181	57	122	.629	.73
June	87	31	59.1	.305	.34

NOTE.—Ice conditions November 29 to December 31, 1903; January 1 to March 7 and December 8 to 27, 1904; February 1 to March 9, 1905.

Values for 1903 are rated as follows: May and August, good; June, July, and September to November, excellent.

Values for 1904 and 1905 are excellent.

DELAWARE AND HUDSON CANAL AT CREEKLOCKS, N. Y.

In order to determine the run-off from the Rondout Creek drainage basin, gagings of the flow in the Delaware and Hudson Canal at the foot of the Rosendale level were made from June, 1901, to December, 1903, inclusive, and were resumed in December, 1905. The diversion to the canal, added to the measured discharge of Rondout gaging station, represents the total flow from the drainage basin. The observations in 1905 and 1906 were made in cooperation with the New York water-supply commission. The conditions at the station are described in Water-Supply Paper No. 166, page 57, where are given also references to publications that contain data for previous years.

Daily discharge in second-feet of Delaware and Hudson Canal at Creeklocks, N. Y., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	21	22	.....	19	22	20	16
2	.....	21	22	21	24	.....	19	17
3	.....	22	.....	21	22	.....	22	18
4	.....	20	23	21	23	21	19	.....
5	.....	20	21	22	.....	25	20	18
6	.....	.....	19	23	21	19	19	19
7	.....	23	23	22	21	21	.....	19
8	.....	21	21	.....	21	22	17	18
9	14	20	23	21	20	.....	17	18
10	13	21	.....	23	23	24	20	19
11	8	20	23	22	22	22	19	.....
12	12	22	22	24	.....	22	20	17
13	11	.....	22	22	24	20	22	19
14	11	23	22	23	21	20	.....	19
15	.....	22	23	.....	23	20	28	19
16	8	20	21	21	22	.....	20	18
17	12	20	.....	23	22	19	21	20
18	17	20	21	21	20	19	20	.....
19	19	22	20	21	.....	17	18	19
20	17	.....	22	22	22	22	20	20
21	19	22	21	22	22	24	.....	18
22	.....	20	23	.....	21	21	19	22
23	18	20	21	23	23	.....	19	21
24	17	19	.....	22	20	18	21	19
25	17	20	22	21	22	18	16	.....
26	17	21	23	23	.....	22	17	17
27	16	.....	23	21	21	18	19	15
28	17	21	22	20	20	23	.....	18
29	.....	20	23	.....	22	20	17	15
30	20	.....	23	22	21	.....	17	[a] 19
31	.....	24	.....	21	19	.....	16	.....

[a] Canal closed for season.

Monthly discharge of Delaware and Hudson Canal at Creeklocks, N. Y., for 1906.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
April (9-30)	20	8	15.0
May	24	19	21.1
June	23	19	22.0
July	24	20	21.8
August	24	19	21.6
September	24	17	20.8
October	28	16	19.5
November	22	15	18.4

NOTE.—Daily discharges interpolated on Sundays and other days when no flow was recorded.

RONDOUT CREEK AT ROSENDALE, N. Y.

This station was established July 6, 1901, at the highway bridge at Rosendale, discontinued November 7, 1903, and reestablished in December, 1905, in cooperation with the New York water-supply commission.

The flow in the Delaware and Hudson Canal at the Rosendale level must be added to that at the gaging station to obtain the total run-off from the drainage area above this point. The conditions at the station are described in Water-Supply Paper No. 166, page 57, where are given also references to publications that contain data for previous years.

The following discharge measurement was made August 23, 1906:

Width, 100 feet; area, 482 square feet; gage height, 6.50 feet; discharge, 261 second-feet.

Daily gage height, in feet, of Rondout Creek at Rosendale, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.08	6.87	7.23	9.05	6.97	6.95	7.20	6.67	6.42	7.00	.....	6.72
2	6.98	6.83	7.15	8.40	6.91	6.87	6.90	6.43	6.32	6.50	6.58	6.70
3	6.92	6.73	7.09	8.17	7.05	6.79	7.45	6.50	6.50	6.28	6.59	6.62
4	7.35	6.67	11.41	8.00	7.03	6.73	7.87	6.90	6.48	6.14	6.54	6.68
5	7.75	6.59	8.87	8.33	6.92	6.70	7.40	6.83	6.50	6.09	6.52	6.82
6	7.35	6.57	7.89	9.15	6.90	7.03	6.93	6.67	6.20	6.05	6.55	6.75
7	7.22	6.50	7.65	8.55	6.95	6.93	6.79	6.47	6.12	6.04	6.49	7.78
8	7.18	6.49	7.53	7.97	6.89	6.73	6.75	8.37	6.10	6.04	6.42	7.12
9	7.12	6.53	7.43	7.80	6.95	6.63	6.60	7.00	6.08	6.30	6.48	7.08
10	6.92	6.63	7.40	11.50	7.27	6.85	6.80	6.70	6.04	6.12	6.42	7.10
11	7.20	6.73	7.17	10.60	7.13	6.80	6.63	6.57	6.05	6.08	6.50	7.02
12	7.40	6.73	7.21	9.57	7.20	6.63	6.65	6.70	6.05	6.08	6.55	6.98
13	7.47	6.74	7.07	8.83	7.00	6.53	6.67	6.55	6.05	6.08	6.80	6.82
14	7.17	6.75	6.97	8.35	6.88	6.53	6.57	6.43	6.04	6.08	6.72	6.85
15	7.08	6.67	6.87	13.67	6.85	6.43	6.40	6.30	6.03	6.05	6.60	6.78
16	7.00	6.63	7.00	11.10	6.77	6.45	6.27	6.27	6.00	6.10	6.62	7.50
17	7.05	6.60	7.10	9.43	6.71	7.17	6.37	6.23	6.00	6.10	6.68	7.20
18	6.93	6.63	6.93	8.55	6.69	7.70	6.10	6.27	5.98	6.05	6.62	7.00
19	6.83	6.67	6.93	8.20	6.69	7.85	6.39	6.19	5.95	6.38	7.92	7.00
20	6.83	6.77	7.05	7.90	6.63	7.50	6.33	6.25	6.02	7.50	7.55	6.85
21	6.73	6.90	6.97	7.67	6.59	7.23	6.23	7.00	6.28	8.00	7.62	7.30
22	7.10	8.90	6.85	7.47	6.53	7.35	6.75	6.67	6.85	7.10	7.30	7.40
23	6.64	8.75	6.79	7.67	6.47	7.43	6.57	6.82	6.65	6.85	7.20	7.20
24	8.61	7.65	6.65	7.75	6.41	7.30	6.45	6.70	6.48	6.72	7.02	6.80
25	7.95	7.75	6.83	7.47	6.45	7.00	6.33	6.38	6.38	6.90	6.92	6.90
26	7.30	7.37	6.73	7.33	6.41	6.87	6.43	6.22	6.28	7.70	6.88	6.80
27	7.17	7.63	6.90	6.93	6.75	6.73	6.33	6.15	6.20	7.28	6.80	6.90
28	7.17	7.43	8.83	7.10	7.55	6.63	6.23	6.42	6.12	7.15	6.78	6.80
29	7.00	.....	8.73	7.03	8.07	6.63	6.23	6.38	6.12	6.95	6.70	6.75
30	6.87	.....	8.60	7.03	7.45	6.55	6.37	6.35	7.15	6.75	6.70	6.80
31	6.73	.....	9.78	.....	6.10	.....	6.73	6.52	.....	6.72	.....	7.20

NOTE.—Ice conditions from February 3 to noon February 22. Ice averaged about 0.5 foot in thickness. No report of ice after this date. December 6 river frozen over; ice went out 3 p. m. December 31. Ice averaged from 0.25 to 0.50 foot thick. During the frozen period the readings were taken to the water surface through a hole cut in the ice for January, February, and March, and to surface of ice for December with extra readings to water surface.

Comparative ice and water readings.

Date.	Water surface.	Top of ice.	Thickness of ice at gage.
	Feet.	*Feet.*	*Feet.*
December 19	6.85	7.0	0.12
December 22	7.4	7.2	.15
December 26	6.8	7.1	.25
December 29	6.75	7.25	.4

Rating table for Rondout Creek at Rosendale, N. Y., for 1901–1903 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.95	32	7.20	712	8.50	2,000	10.60	4,430
6.00	50	7.30	799	8.60	2,108	10.80	4,675
6.10	86	7.40	885	8.70	2,216	11.00	4,920
6.20	121	7.50	971	8.80	2,323	11.20	5,184
6.30	157	7.60	1,071	8.90	2,431	11.40	5,440
6.40	192	7.70	1,171	9.00	2,539	11.60	5,706
6.50	228	7.80	1,272	9.20	2,764	11.80	5,978
6.60	290	7.90	1,372	9.40	2,984	12.00	6,250
6.70	353	8.00	1,472	9.60	3,222	13.00	7,640
6.80	415	8.10	1,578	9.80	3,461	14.00	9,070
6.90	478	8.20	1,683	10.00	3,700		
7.00	540	8.30	1,789	10.20	3,943		
7.10	626	8.40	1,894	10.40	4,186		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1901-1906, and is well defined between gage heights 6.1 feet and 7.0 feet. Above 7.0 feet the rating is approximate.

Monthly discharge of Rondout Creek at Rosendale, N. Y., for 1906.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
January	2,120	316	700
March	5,490	322	1,100
April	8,600	497	2,150
May	1,550	86	493
June	1,320	203	520
July	1,340	132	355
August	1,860	103	315
September	669	32	150
October	1,470	64	342
November	1,390	199	434

NOTE.—Values for 1906 are fair.

MISCELLANEOUS MEASUREMENTS IN HUDSON RIVER DRAINAGE BASIN.

Miscellaneous discharge measurements in Hudson River drainage basin in 1904 and 1906.

Date.	Stream.	Locality.	Width.	Area of section.	Gage height.	Discharge.
			Feet.	*Sq.-ft.*	*Feet.*	*Sec.-ft.*
1904.						
July 30[a]	Hudson River	Corinth, N. Y.		1,220	126.16	2,600
August 25[a]	do	do		1,500	126.92	4,480
September 10[a]	do	do		1,150	126.03	2,360
September 26[a]	do	do		1,440	126.87	3,910
September 28[a]	do	do		1,500	126.95	4,360
October 2[a]	do	do		1,930	127.92	7,050
October 22[a]	do	do		3,050	130.45	17,970
1906.						
September 11[b]	Hudson River	do	507	994	125.9	1,670
September 12[b]	do	do	507	1,050	125.82	1,730
November 1[c]	do	do	488	1,650	126.12	2,580
August 19	Sacandaga River	Near Northville	52	81.4	.23	134
August 20	do	do	52	81.4	.20	132
August 23	Schoharie Creek	Middleburg, N. Y.			1.93	249
August 23	do	do			1.55	267
August 25	do	do			1.40	[d] 108
September 7	do	do	90	140	1.30	78
September 7	do	do	90	141	1.28	74
August 24	do	First bridge below Schoharie Junction.			([e])	195
August 22	Fox Creek	Near junction Schoharie Creek.				57
August 23	do	do				59
August 25	do	do				46
April 3	Oriskany Creek	Walesville Upper Bridge.	60	213	[f] 1.72	322
April 3	Small stream just below Walesville.		15.4	10.4		7.9

[a] Measured from boat above highway bridge.
[b] Measured by boat above highway bridge.
[c] Measured from highway bridge.
[d] Meter thought to be out of order.
[e] Water surface 27.6 feet below top of iron bars right-hand end of bridge, downstream side.
[f] Gage at Coleman.

PASSAIC RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Passaic River rises in Somerset and Morris counties, N. J. Above its confluence with Pompton River, its main tributary, it meanders through a flat country of Triassic red sandstone, to which in large measure must be attributed the turbidity of its waters. In contrast with the sluggish, muddy character of the Passaic, the Pompton is a rapid stream, and its waters are clear. It drains parts of Sussex, Passaic, Morris, and other adjoining counties, and traverses for a large part of its course a country of hard crystalline rocks and heavy forests, the general level of which is several hundred feet above that of the Passaic. At their confluence the Pompton enters with a current which carries it well toward the right bank of the Passaic, and at times of flood causes much backwater in the latter.

The highest recorded flood which has occurred in this drainage basin was that of October, 1903. The flood began at 6.30 p. m. October 8 and lasted until midnight October 18, the maximum height being reached at 9 p. m. October 10. There was a total rainfall of 11.74 inches between October 8 and 11. The estimated maximum discharge at the Dundee dam was 35,800 second-feet. This flood is fully described in Water-Supply Paper No. 92.

PASSAIC RIVER AT MILLINGTON, N. J.

This station was established November 25, 1903, and was discontinued July 15, 1906. It is located at the lower highway bridge at Millington, N. J. The conditions at the bench marks are described in Water-Supply Paper No. 167, page 59, where are given also references to publications that contain data for previous years.

Discharge measurements of Passaic River at Millington, N. J., for 1903 to 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1903.					
December 10	F. H. Tillinghast	.....	71	1.80	78
December 18[a]	do	.....	109	2.50	66
1904.					
April 9	F. H. Tillinghast	65	90	2.12	133
May 13	F. H. Brundage	57	37	1.36	38
June 4	John C. Hoyt	63	63	1.65	75
August 1	do	55	27	1.20	21
November 9	H. D. Comstock	62	44	1.42	38
1905.					
June 21	R. H. Bolster	54	24	1.12	12.8
1906					
May 3	Robert Follansbee	63	65	1.82	83

[a] Measurement affected by ice jams below the gaging section.

Daily gage height, in feet, of Passaic River at Millington, N. J., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July
1	1.95	1.58	2.20	3.00	1.60	2.15	1.30
2	1.65	1.58	1.80	2.65	1.65	1.85	1.28
3	1.58	2.05	2.25	2.45	1.70	1.65	1.22
4	3.15	1.68	5.80	2.05	1.70	1.50	2.20
5	3.20	1.52	5.15	1.95	1.60	1.42	2.25
6	2.80	1.60	4.72	2.00	1.60	1.40	1.95
7	2.38	1.52	3.45	1.90	1.65	1.32	1.72
8	2.25	1.55	2.60	1.80	1.68	1.30	1.45
9	1.85	1.70	2.90	1.85	1.68	1.30	1.40
10	2.10	1.70	2.70	4.90	1.70	1.30	1.35
11	1.98	1.70	2.60	4.95	1.62	1.30	1.48
12	1.62	1.70	2.45	4.00	1.55	1.28	1.40
13	1.88	1.70	2.40	3.10	1.55	1.22	1.35
14	1.82	1.78	2.25	2.45	1.55	1.15	1.22
15	1.95	1.88	2.10	3.85	1.52	1.15	1.20
16	2.30	1.82	2.15	4.20	1.50	1.30	.....
17	2.45	1.68	2.55	3.55	1.50	1.45	.....
18	2.28	1.75	2.50	2.75	1.48	1.50	.....
19	2.10	1.72	2.15	2.40	1.40	1.78	.....
20	1.95	1.70	2.20	2.20	1.38	1.68	.....
21	1.95	1.98	2.35	2.05	1.32	1.55	.....
22	2.00	3.72	2.10	1.95	1.30	1.55	.....
23	2.00	3.10	2.05	2.05	1.30	1.42	.....
24	1.90	2.68	1.75	.....	1.30	1.48	.....
25	1.82	2.35	1.60	.....	1.30	1.38	.....
26	1.72	2.55	1.65	.....	1.30	1.25	.....
27	1.62	2.22	1.95	.....	1.38	1.22	.....
28	1.68	1.92	3.20	.....	2.00	1.20	.....
29	1.72	.....	3.90	1.65	2.90	1.30	.....
30	1.58	.....	3.55	1.65	2.68	1.32	.....
31	1.55	.....	3.45	.....	2.42	.....	.....

NOTE.—River frozen February 2 to 21.

Rating table for Passaic River at Millington, N. J., for 1903 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	7	2.10	128	3.30	398	5.00	935
1.00	10	2.20	146	3.40	424	5.20	1,005
1.10	14	2.30	164	3.50	452	5.40	1,075
1.20	20	2.40	184	3.60	480	5.60	1,145
1.30	28	2.50	204	3.70	510	5.80	1,215
1.40	37	2.60	226	3.80	540	6.00	1,285
1.50	47	2.70	248	3.90	570	6.20	1,360
1.60	58	2.80	272	4.00	600	6.40	1,440
1.70	70	2.90	296	4.20	664	6.60	1,520
1.80	82	3.00	320	4.40	728	6.80	1,600
1.90	96	3.10	346	4.60	795	7.00	1,680
2.00	112	3.20	372	4.80	865	7.20	1,760

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1903-1906 and is well defined between gage heights 1.0 feet and 2.5 feet. The extension of this rating is only approximate at gage height, 7.3 feet.

Monthly discharge of Passaic River at Millington, N. J., for 1903 to 1906.

[Drainage area, 57 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-feet per sq. mile.	Depth in inches.
1903.[a]					
November 25 to 30	80	56	65.3	1.15	0.26
December[b]	858	26	130	2.28	2.63
1904.[c]					
January[d]	.....	.....	80	1.40	1.61
February[d]	.....	.....	100	1.75	1.89
March[d]	[g] 1,750	.....	277	4.86	5.60
April	600	39	152	2.67	2.98
May	194	17	58.1	1.02	1.18
June	104	12	37.2	.653	.73
July	72	11	23.7	.416	.48
August	260	24	102	1.79	2.06
September	907	14	155	2.72	3.03
October	616	20	106	1.86	2.14
November	194	35	67.1	1.18	1.32
December[d]	.....	.....	50	.877	1.01
The year	1,750	11	101	1.77	24.03
1905.[e]					
January[f]	.....	.....	130	2.28	2.63
February[f]	.....	.....	30	.526	.55
March[f]	[g] 1,180	.....	330	5.79	6.68
April	296	47	107	1.88	2.10
May	60	24	35.2	.618	.71
June	56	14	24.3	.426	.48
July	52	8	15.8	.277	.32
August	180	12	39.1	.686	.79
September	367	17	133	2.33	2.60
October	150	19	40.9	.718	.83
November	341	17	36.0	.632	.71
December	346	35	138	2.42	2.79
The year	1,180	8	88.3	1.55	21.18
1906.[h]					
January	372	52	125	2.19	2.52
February[i]	.....	.....	75	1.32	1.38
March[i]	.....	.....	200	3.51	4.05
April[j]	917	64	251	4.40	4.91
May	296	28	70.0	1.23	1.42
June	137	17	41.6	.730	.81
July 1 to 15	155	20	54.7	.960	.54

[a] Values for 1903 are rated as follows: November, good; December, fair.

[b] Ice conditions. Mean discharge determined partly from the flow of North Branch of Raritan River, at Pluckemin, N. J., during December, 1903.

[c] Values for 1904 are rated as follows: April to November, good; March, fair; January, February, and December, approximate.

[d] Ice conditions January 1 to March 8 and during parts of December. Estimates for the frozen periods are based on the flow at Pluckemin, N. J., and are considered conservative.

[e] Values for 1905 are rated as follows: April to December, good; January to March, approximate. The gage zero was checked against the bench marks on June 21, 1905, and May 3, 1906. On the latter date it was found to be 0.14 in error, but no information is available to show when the error occurred. Consequently no corrections in gage heights were made for the latter part of 1905, and those estimates may be somewhat too high. Gage heights for 1906 were, however, corrected, which should give reasonably close estimates. The estimates of accuracy have been made on the assumption that no error existed in the gage heights.

[f] Ice conditions January 1 to March 17; estimates based on flow at Pluckemin, N. J.

[g] Open channel.

[h] Values for 1906 are rated as follows: April to July, good (see footnote 1905); January, fair; February and March, approximate.

[i] Ice conditions during February and probably backwater during March, owing to ice lodged at and below the gaging section. Estimates based on estimates at Pluckemin and at Chatham, N. J.

[j] Discharge interpolated April 24 to 28.

NOTE.—Flow at the Pluckemin station is probably only affected by a smooth ice cover during frozen periods. North Branch of Raritan is a deep, sluggish stream at the Pluckemin station. The Millington section, on the other hand, is shallow and rocky and collects much ice drift, frequently causing backwater at the gaging section, thus rendering the daily gage heights of little value as an index of the discharge. Knowing the ice thickness at Pluckemin it has been possible to obtain good estimates at that point for ice periods. A coefficient based on the relative flow at Millington and Pluckemin was used to find flow at the former.

The following table gives the horsepower, 80 per cent efficiency, per foot of fall that may be developed at different rates of discharge and shows the number of days on which the flow and the corresponding horsepower were respectively less than the amounts given in the columns for "discharge" and "horsepower."

Discharge and horsepower table for Passaic River at Millington, N. J.

Discharge in second-feet.	H. P. per foot fall; 80 per cent efficiency.	Number of days of deficient flow.			
		1903.[a]	1904.	1905.	1906.[b]
11	1	.....	.....	5	.....
22	2	.....	19	80	4
33	3	1	87	182	43
44	4	4	128	211	57
55	5	9	195	240	71

[a] November 25 to December 31, 1903. [b] January 1 to July 15, 1906.

PASSAIC RIVER NEAR CHATHAM, N. J.

This station was established February 10, 1903, by the United States Weather Bureau, by which it is maintained. It is located at the second bridge, about 1.5 miles upstream from Chatham, N. J. The conditions and the bench marks are described in Water-Supply Paper No. 167, page 61, where are given also references to publications that contain data for previous years.

The following discharge measurement was made May 3, 1906:

Width, 65 feet; area, 95 square feet; gage height, 2.74 feet; discharge, 106 second-feet.

Daily gage height, in feet, of Passaic River, near Chatham, N. J., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.3	2.6	2.6	4.2	2.7	3.2	3.1	3.7	2.3	2.2	2.8	2.3
2	3.2	2.5	2.6	3.8	2.6	3.0	2.8	3.4	2.2	2.2	2.7	2.2
3	3.2	.....	2.7	3.5	2.7	2.9	2.5	3.6	2.2	2.2	2.6	2.2
4	4.1	.....	4.9	3.4	2.6	2.8	3.0	3.7	2.2	2.1	2.6	.....
5	4.0	.....	4.9	3.2	2.6	2.7	3.8	3.6	2.2	2.2	2.5	.....
6	3.9	.....	4.5	3.2	2.6	2.6	3.6	3.4	2.2	2.3	2.5	.....
7	3.5	.....	4.2	3.1	2.8	2.5	3.3	3.0	2.1	2.3	2.4	2.8
8	3.3	.....	4.0	2.9	2.7	2.5	2.9	3.3	2.1	2.3	2.4	.....
9	3.8	.....	3.6	2.8	2.7	2.4	2.5	3.2	2.1	2.2	2.3	.....
10	3.5	.....	3.3	5.0	2.8	2.4	2.3	3.0	2.1	2.2	2.3	.....
11	3.3	.....	3.2	4.8	2.7	2.4	2.4	2.9	2.1	2.2	2.3	2.9
12	3.0	.....	3.1	4.7	2.7	2.3	2.3	3.3	2.1	2.1	2.5	2.8
13	3.1	.....	3.0	4.5	2.7	2.3	2.2	3.2	2.1	2.1	2.5	2.7
14	3.1	.....	2.8	4.4	2.8	2.3	2.2	3.0	2.1	2.1	2.4	2.6
15	3.2	.....	2.7	5.0	2.7	2.2	2.2	2.9	2.0	2.1	2.3	2.6
16	3.3	.....	2.9	5.3	2.7	2.2	2.1	2.8	2.0	2.1	2.6	2.5
17	3.6	.....	2.8	4.5	2.6	2.4	2.1	2.7	2.0	2.0	2.5	2.6
18	3.4	.....	2.8	4.4	2.6	2.5	2.8	2.7	2.0	2.0	2.5	2.9
19	3.3	.....	2.7	3.9	2.6	2.7	2.7	2.7	2.0	2.0	3.2	.....
20	3.1	.....	2.7	3.5	2.5	3.1	2.5	2.6	2.0	2.0	3.2	.....
21	3.0	.....	2.6	3.2	2.5	2.9	2.3	2.5	2.0	2.3	3.1	4.0
22	3.0	3.6	2.6	3.0	2.5	2.8	2.7	2.5	2.0	2.7	3.0	3.8
33	2.9	4.3	2.6	2.8	2.4	2.7	2.9	2.4	2.1	2.8	2.9	.....
24	3.0	4.0	2.5	3.4	2.4	2.8	2.8	2.4	2.1	3.0	2.8	.....
25	3.0	3.4	2.5	3.3	2.4	2.7	2.7	2.4	2.0	3.0	2.7	.....
26	2.9	3.3	2.8	3.2	2.4	2.6	2.6	2.3	2.0	2.9	2.6	.....
27	2.9	3.0	3.2	3.0	2.3	2.5	2.5	2.4	2.0	2.8	2.5	.....
28	2.8	2.7	4.0	2.9	2.7	2.4	2.4	2.5	2.1	2.7	2.5	.....
29	2.7	.....	4.6	2.8	4.0	3.4	3.9	2.4	2.1	2.7	2.4	.....
30	2.7	.....	4.5	2.8	3.8	3.3	4.2	2.3	2.2	2.6	2.3	.....
31	2.6	.....	4.4	.....	3.5	.....	4.0	2.3	.....	2.6	.....	.....

NOTE.—Ice conditions January 9 to 16, February 3 to 22, February 28 to March 2, March 19 to 23, December 4 to 6, 8 to 10, 19 to 20, and 23 to 31.

Rating table for Passaic River, near Chatham, N. J., for 1903 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	2	2.90	124	3.70	391	4.50	758
2.10	4	3.00	149	3.80	433	4.60	809
2.20	9	3.10	176	3.90	476	4.70	861
2.30	17	3.20	206	4.00	520	4.80	914
2.40	29	3.30	239	4.10	565	4.90	968
2.50	44	3.40	274	4.20	611	5.00	1,022
2.60	61	3.50	312	4.30	659	5.20	1,132
2.70	80	3.60	351	4.40	708	5.40	1,245
2.80	101						

NOTE.—The above table is applicable only for open-channel conditions. It is based on 14 discharge measurements made during 1903 to 1905, and is well defined between gage heights 2.28 feet and 3.8 feet. At gage heights 2.0 and 2.1 feet the rating is approximate.

Monthly discharge of Passaic River near Chatham, N. J., for 1906.

[Drainage area, 101 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January[a]	[b]565	[b]61	203	2.01	2.32
February[a]	[b]659	.....	122	1.21	1.26
March[a]	[b]968	.....	293	2.90	3.34
April	1,190	101	427	4.28	4.72
May	520	17	98.7	.977	1.13
June	274	9	80.9	.801	.89
July	611	4	133	1.32	1.52
August	891	17	140	1.39	1.60
September	17	2	4.7	.047	.05
October	149	2	34.7	.344	.40
November	206	17	67.3	.666	.74
December[a]	[b]520	[b]9	85.3	.845	.97
The year	1,190	2	141	1.40	18.94

[a] Ice conditions during January, February, March, and December. Daily flow during frozen periods determined largely by the flow of North Branch of Raritan River at Pluckemin, N. J. The section at the latter point is deep, and the flow during ice periods is probably only affected by a smooth ice cover. The Chatham section is shallow, and at times the collection of ice below the gage causes backwater.

[b] Open channel.

NOTE.—Values are rated as follows: April to August, October and November, good; January to March, September and December, approximate.

RAMAPO RIVER NEAR MAHWAH, N. J.

This station was established February 10, 1903, by the United States Weather Bureau, by which it is maintained. It is located at a concrete-arch highway bridge about 1 mile west of Mahwah, N. J. The conditions and the bench marks are described in Water-Supply Paper No. 167, page 64, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Ramapo River, near Mahwah, N. J., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.0	3.7	.....	5.1	3.6	4.6	3.0	3.5	3.0	2.8	3.0	3.0
2	3.9	3.6	3.9	4.8	3.8	4.3	2.9	3.4	2.9	2.7	2.9	3.0
3	3.7	3.6	3.8	4.6	3.8	4.0	2.9	4.0	2.8	2.7	2.8	3.1
4	3.7	3.4	6.9	4.5	3.8	3.8	4.6	4.5	2.9	2.6	2.8	3.0
5	4.6	3.3	6.1	4.4	3.8	3.7	4.1	4.1	2.9	2.6	2.8	3.0
6	4.4	.....	5.0	4.3	3.7	3.6	3.7	3.8	2.8	2.6	2.8	3.1
7	4.2	.....	4.8	4.3	3.8	3.8	3.5	3.6	2.8	2.6	2.8	3.5
8	4.0	.....	4.6	4.2	3.8	3.6	3.4	3.8	2.8	2.7	2.8	3.4
9	4.0	.....	4.5	4.2	3.8	3.5	3.3	3.7	2.8	2.6	2.7	.....
10	3.7	.....	4.4	6.4	4.0	3.6	3.2	3.4	2.7	2.7	2.7	.....
11	3.6	.....	4.3	6.1	3.9	3.5	3.1	3.3	2.7	2.8	2.7	3.4
12	3.5	.....	4.1	5.3	3.9	3.8	3.0	3.3	2.7	2.7	3.1	.....
13	4.0	.....	4.0	4.9	3.8	3.2	3.0	3.2	2.8	2.7	3.0	.....
14	4.0	3.4	3.9	4.7	3.6	3.2	3.0	3.1	2.7	2.6	2.9	3.2
15	4.0	3.4	3.8	5.1	4.0	3.2	2.9	3.1	2.8	2.6	2.9	3.2
16	4.0	.....	3.6	5.6	3.8	3.1	2.9	2.9	2.7	2.6	3.0	3.4
17	3.9	.....	3.9	5.3	3.6	3.6	2.9	2.9	2.7	2.6	3.0	3.4
18	3.9	3.3	3.7	4.9	3.6	3.5	3.0	2.8	2.6	2.6	3.0	3.4
19	4.0	3.3	3.6	4.6	3.6	3.7	2.9	2.8	2.6	2.7	3.6	3.2
20	4.0	3.3	3.7	4.5	3.5	3.5	2.8	2.8	2.6	2.7	4.0	.....
21	3.9	3.5	3.7	4.4	3.4	3.5	2.8	2.9	2.9	3.8	3.8	3.8
22	3.9	5.1	3.7	4.3	3.4	3.4	3.2	2.9	2.8	3.5	3.7	4.1
23	3.9	4.9	3.7	4.3	3.4	3.3	4.1	2.9	3.6	3.3	3.5	3.8
24	4.1	4.4	3.6	4.4	3.3	3.3	4.0	3.2	3.1	3.1	3.4	.....
25	4.1	4.2	3.5	4.4	3.3	3.3	3.7	3.4	2.9	3.3	3.3	.....
26	4.0	4.8	3.6	4.2	3.2	3.2	3.3	3.2	2.8	3.6	3.2	.....
27	3.9	4.4	3.7	4.0	3.2	3.2	3.2	3.1	2.8	3.4	3.2	.....
28	3.8	4.1	5.3	3.9	5.0	3.2	3.1	3.6	2.8	3.2	3.1	.....
29	3.8	.....	5.4	3.7	6.2	3.1	3.0	3.3	2.8	3.1	3.1	3.2
30	3.8	.....	5.2	3.7	5.7	3.0	3.6	3.2	2.8	3.1	3.0	3.4
31	3.7	.....	5.2	.....	5.0	.....	4.1	3.1	.....	3.1	.....	3.4

NOTE.—River frozen January 10 to 15, February 6 to 19, March 1 and 2, December 8 to 13, 19 to 20, and 24 to 29.

Rating table for Ramapo River near Mahwah, N. J., for 1905 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.60	24	3.60	167	4.60	546	5.60	1,075
2.70	30	3.70	194	4.70	593	5.70	1,133
2.80	37	3.80	224	4.80	641	5.80	1,191
2.90	46	3.90	257	4.90	691	5.90	1,250
3.00	56	4.00	293	5.00	743	6.00	1,310
3.10	68	4.10	331	5.10	796	6.20	1,433
3.20	82	4.20	371	5.20	850	6.40	1,560
3.30	99	4.30	413	5.30	905	6.60	1,690
3.40	119	4.40	456	5.40	961	6.80	1,820
3.50	142	4.50	500	5.50	1,018	7.00	1,950

NOTE.—The above table is applicable only for open-channel conditions. It is based on 6 discharge measurements made during 1904 to 1905, and is well defined between gage heights 2.65 feet and 6.0 feet.

Monthly discharge of Ramapo River near Mahwah, N. J., for 1906.

[Drainage area, 118 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	546	.....	275	2.33	2.69
February	798	.....	209	1.77	1.84
March	1,880	142	454	3.85	4.44
April	1,560	194	588	4.98	5.56
May	1,430	82	292	2.47	2.85
June	546	56	156	1.32	1.47
July	546	37	126	1.07	1.23
August	500	37	124	1.05	1.21
September	167	24	41.8	.354	.40
October	224	24	56.7	.481	.55
November	293	30	79.7	.675	.75
December	331	56	103	.873	1.01
The year	1,880	24	209	1.77	24.00

NOTE.—Values are rated as follows: March to November, excellent; January, good; February and December, fair. Since this station has not been visited since June, 1905, the above estimates of accuracy are dependent on the constancy of conditions of flow at the station since that time. Discharge during ice periods estimated.

RARITAN RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Raritan River, the largest stream in New Jersey except the Delaware, is formed by two chief branches, North and South, which have their sources a few miles apart in the highlands of Morris County, flow southward, and unite near Somerville, from which point the course of the river is southeastward to Raritan Bay. The river is tidal to a point about 2 miles above New Brunswick, and is navigable to that city, about 12 miles from the mouth.

The total area of the drainage basin is 1,105 square miles, about 10 per cent of which is forested. The highlands consist mostly of trap rock and contain a large proportion of the wooded areas of the basin. The area outside of the highlands consists either of trap rock or red sandstone. Of the 800 square miles of drainage area above the gaging station at Boundbrook, about 150 square miles are in the cultivated part of the highlands and on the trap ridges; the remainder is mostly on the low, level, red-sandstone plain.

The valley of the Raritan is populous and highly cultivated, and a large amount of water power is utilized on its various branches. North Branch is considered a valuable source for a gravity supply, the elevation of the upper portion ranging from 750 to 1,100 feet. Millstone River, an important stream which unites with the Raritan a few miles west of Boundbrook, differs from the other branches, having its rise in sand hills and flowing northwestward through a sandy soil. It has large ground storage, and is better suited for power than for water supply, being very muddy at high stages.

SOUTH BRANCH RARITAN RIVER AT STANTON, N. J.

This station was established July 2, 1903, at the highway bridge about 500 feet from the Lehigh Valley Railroad station at Stanton, N. J. The conditions and the bench marks are described in Water-Supply Paper No. 167, page 68, where are given also references to publications that contain data for previous years.

The following discharge measurement was made May 4, 1906:

Width, 98 feet; area, 173 square feet; gage height, 2.94 feet; discharge, 219 second-feet.

Daily gage height, in feet, of South Branch Raritan River at Stanton, N. J., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.31	3.02	3.01	3.18	2.92	2.91	3.08	3.46	2.39	2.11	2.46	2.68
2	3.39	3.00	3.04	3.15	2.91	2.81	3.09	3.48	2.36	2.16	2.49	2.74
3	3.30	3.02	5.45	3.21	2.96	2.90	2.88	3.24	2.31	2.21	2.54	2.78
4	3.29	3.11	5.56	3.19	2.84	2.82	2.80	2.88	2.30	2.29	2.39	2.86
5	3.22	3.08	4.08	3.22	2.81	2.79	2.80	2.79	2.25	2.29	2.59	2.71
6	3.14	3.02	3.56	3.21	2.81	2.79	2.76	2.64	2.24	2.28	2.58	2.76
7	3.04	3.05	3.40	3.16	2.82	2.80	2.76	2.68	2.26	2.34	2.54	2.89
8	2.96	3.11	3.28	3.14	2.80	2.76	2.66	2.59	2.21	2.34	2.49	2.89
9	2.96	2.99	3.21	3.08	2.79	2.71	2.68	2.51	2.21	2.26	2.52	2.96
10	2.98	3.04	3.22	3.01	2.80	2.76	2.66	2.51	2.16	2.22	2.46	2.88
11	3.18	2.90	3.20	3.00	2.81	2.68	2.61	2.52	2.18	2.24	2.96	2.89
12	3.25	2.96	3.21	3.01	2.84	2.69	2.58	2.50	2.18	2.28	2.99	2.81
13	3.08	2.91	3.19	2.95	2.92	2.56	2.56	2.55	2.16	2.24	2.81	2.82
14	3.12	2.89	3.16	3.01	2.89	2.59	2.52	2.59	2.14	2.26	2.76	2.79
15	3.11	2.82	3.16	4.61	2.82	2.45	2.42	2.61	2.19	2.12	2.68	2.84
16	3.35	2.96	3.19	4.28	2.81	2.49	2.41	2.48	2.19	2.21	2.58	2.91
17	3.09	3.15	3.14	3.74	2.80	2.44	2.40	2.56	2.16	2.32	2.48	2.98
18	3.09	3.16	3.09	3.41	2.79	2.49	2.89	2.55	2.12	2.01	2.51	3.16
19	3.11	3.41	3.12	3.36	2.75	2.49	2.61	2.41	2.16	2.18	2.50	3.19
20	3.08	3.39	3.16	3.32	2.86	2.51	2.59	2.40	2.01	2.26	2.49	3.18
21	3.05	3.45	3.19	3.30	2.86	2.50	2.59	2.41	2.01	2.56	2.44	3.30
22	3.11	4.75	3.16	3.25	2.81	2.49	2.62	2.42	2.16	3.10	2.49	3.12
23	3.08	3.61	3.20	3.16	2.81	2.45	2.59	2.49	2.41	2.82	2.48	3.42
24	3.06	3.39	3.19	3.09	2.85	2.71	2.61	2.51	2.30	2.81	2.48	3.79
25	3.00	3.55	3.09	3.11	2.86	4.00	2.54	2.44	2.22	2.69	2.51	3.34
26	3.02	3.42	3.16	3.01	2.84	3.64	2.51	2.49	2.20	2.64	2.54	3.21
27	3.11	3.18	3.52	2.98	3.31	3.01	2.59	2.59	2.25	2.61	2.52	3.34
28	3.10	3.11	3.82	2.94	4.30	2.81	2.60	2.56	2.25	2.59	2.49	3.72
29	3.18	.....	3.68	2.92	4.05	2.76	5.01	2.41	2.22	2.61	2.46	3.75
30	3.09	.....	3.51	2.98	3.81	2.71	3.76	2.40	2.24	2.49	2.56	3.66
31	2.98	.....	3.31	.....	3.56	.....	3.46	2.42	.....	2.52	.....	5.22

NOTE.—Ice conditions February 8 to 19; also December 21 to 30; ice attaining a thickness of 0.3 foot during both periods.

Rating table for South Branch Raritan River at Stanton, N. J., for 1905 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	37	3.00	231	4.00	645	5.00	1,180
2.10	46	3.10	264	4.10	694	5.10	1,238
2.20	57	3.20	299	4.20	744	5.20	1,297
2.30	70	3.30	337	4.30	795	5.30	1,357
2.40	86	3.40	377	4.40	847	5.40	1,417
2.50	105	3.50	419	4.50	900	5.50	1,478
2.60	126	3.60	462	4.60	954	5.60	1,539
2.70	149	3.70	506	4.70	1,009		
2.80	174	3.80	551	4.80	1,065		
2.90	201	3.90	597	4.90	1,122		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 11 discharge measurements made during 1903 to 1906 and is well defined between gage heights 2.1 feet and 4.4 feet.

Monthly discharge of South Branch Raritan River at Stanton, N. J., for 1906.

[Drainage area, 158 square miles.]

Month	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	373	219	274	1.73	1.99
February	1,040	.....	288	1.82	1.90
March	1,510	234	410	2.59	2.99
April	960	207	323	2.04	2.28
May	795	161	245	1.55	1.79
June	645	94	174	1.10	1.23
July	1,190	86	197	1.25	1.44
August	411	86	138	.873	1.01
September	88	38	59.9	.379	.42
October	264	38	91.8	.581	.67
November	228	84	119	.753	.84
December	1,310	.....	238	1.51	1.74
The year	1,510	38	213	1.35	18.30

NOTE.—Values are rated as follows: January and March to July, excellent; February and December, fair; August to November, good. Discharge during ice periods estimated.

NORTH BRANCH OF RARITAN RIVER NEAR PLUCKEMIN, N. J.

This station was established September 9, 1903, and was discontinued July 15, 1906. It is located at the second bridge below Far Hills, N. J., on the road to Somerville, about 2 miles from Far Hills. The conditions and the bench marks are described in Water-Supply Paper No. 167, page 70, where are given also references to publications that contain data for previous years.

Discharge measurements of North Branch of Raritan River near Pluckemin, N. J., for 1903 to 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1903.					
September 9	E. P. Roundey	.....	165	1.70	74
October 20	Wm. Nunn	.....	204	2.30	163
1904.					
May 12	F. H. Brundage	55	160	1.51	56
November 9	H. D. Comstock	55	172	1.70	63
1905.					
June 21	R. M. Packard	55	146	1.25	24.6
March 16	F. H. Tillinghast	46	69	2.30	108
1906.					
May 3	Robert Follansbee	56	169	1.80	95

Daily gage height, in feet, of North Branch of Raritan River, near Pluckemin, N. J., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	2.00	1.75	1.85	2.35	1.80	1.90	1.48
2	1.90	1.80	1.80	2.05	1.80	1.82	1.30
3	3.40	2.00	2.25	1.98	1.85	1.78	1.30
4	3.00	1.90	2.95	1.90	1.72	1.72	2.20
5	2.00	1.85	2.48	1.90	1.60	1.68	1.70
6	2.00	2.00	2.38	1.90	1.70	1.60	1.58
7	2.00	2.00	2.28	1.90	1.78	1.62	1.45
8	2.00	2.00	2.08	1.90	1.70	1.50	1.38
9	2.00	2.15	2.00	2.15	1.70	1.45	1.50
10	2.00	2.05	1.90	3.68	1.62	1.40	1.65
11	2.00	2.10	1.90	2.75	1.58	1.40	1.42
12	2.20	2.20	1.90	2.60	1.52	1.35	1.38
13	2.20	2.10	1.90	2.60	1.50	1.30	1.22
14	2.20	1.82	1.90	2.60	1.50	1.30	1.20
15	2.10	1.75	1.80	3.60	1.50	1.30	1.20
16	2.25	1.78	1.88	2.70	1.50	2.20	.....
17	2.00	1.70	1.80	2.48	1.50	2.00	.....
18	2.00	1.70	1.75	2.38	1.50	2.65	.....
19	2.00	1.65	1.75	2.90	1.50	1.90	.....
20	1.90	1.60	1.68	2.45	1.45	1.90	.....
21	1.92	2.10	1.58	2.05	1.45	1.85	.....
22	2.00	2.50	1.50	1.90	1.40	1.82	.....
23	2.00	2.05	1.50	1.90	1.40	1.80	.....
24	2.00	1.90	1.50	1.90	1.42	1.72	.....
25	2.00	2.50	1.50	1.85	1.30	1.58	.....
26	1.95	2.15	1.55	1.82	1.30	1.50	.....
27	1.90	1.98	2.30	1.80	2.95	1.50	.....
28	1.90	1.90	2.80	1.80	3.00	1.50	.....
29	1.85	.....	2.70	1.80	2.35	1.80	.....
30	1.75	.....	2.50	1.88	2.05	1.70	.....
31	1.75	.....	2.55	.....	1.92	.....	.....

NOTE.—River frozen February 2 to 19.

Rating table for North Branch of Raritan River, near Pluckemin, N. J., for 1903 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	13	2.40	177	3.70	420	5.00	705
1.20	20	2.50	194	3.80	440	5.10	730
1.30	29	2.60	211	3.90	460	5.20	755
1.40	39	2.70	228	4.00	480	5.30	780
1.50	50	2.80	246	4.10	500	5.40	805
1.60	62	2.90	264	4.20	520	5.50	830
1.70	74	3.00	282	4.30	540	5.60	855
1.80	87	3.10	301	4.40	560	5.70	880
1.90	101	3.20	320	4.50	580	5.80	905
2.00	115	3.30	340	4.60	605	5.90	930
2.10	130	3.40	360	4.70	630	6.00	960
2.20	145	3.50	380	4.80	655	6.20	1,020
2.30	161	3.60	400	4.90	680	6.40	1,080

NOTE.—The above table is applicable only for open-channel conditions. It is based on 6 discharge measurements made during 1903–1906 and is fairly well defined between gage heights 1.2 feet and 2.5 feet. The above rating is approximate at gage height 6.4 feet.

Monthly discharge of North Branch of Raritan River, near Pluckemin, N. J., for 1903 to 1906.

[Drainage area, 52 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1903.[a]					
September 9 to 30	320	50	102	1.96	1.60
October	1,110	48	180	3.46	3.99
November[b]	115	[c] 70	82.6	1.59	1.77
December[b]	[d] 540	[c] 50	129	2.48	2.86
1904.[e]					
January[f]	[d] 1,030	[c] 50	137	2.63	3.03
February[f]	[d] 1,000	[c] 70	178	3.42	3.69
March	767	87	157	3.02	3.48
April	255	74	116	2.23	2.49
May	174	29	68.7	1.32	1.52
June	168	20	65.5	1.26	1.41
July	246	29	65.6	1.26	1.45
August	560	39	109	2.10	2.42
September[g]	.....	39	175	3.37	3.76
October	592	50	112	2.15	2.48
November	273	74	151	2.90	3.24
December[f]	[c] 120	[c] 30	56.1	1.08	1.24
The year	1,030	20	116	2.23	30.21
1905.[h]					
January[i]	[d] 680	[c] 60	151	2.90	3.34
February[i]	[c] 70	[c] 20	36.4	.700	.73
March[i]	[d] 460	[c] 20	190	3.65	4.21
April	211	56	112	2.15	2.40
May	74	24	44.8	.862	.99
June	74	16	33.1	.637	.71
July	237	13	46.6	.896	1.03
August	310	20	62.5	1.20	1.38
September	400	62	164	3.15	3.51
October	145	44	68.1	1.31	1.51
November	500	39	74.5	1.43	1.60
December	400	50	139	2.67	3.08
The year	680	13	93.5	1.80	24.49
1906.[j]					
January	360	80	128	2.46	2.84
February[k]	[d] 194	[c] 40	79.4	1.53	1.59
March	273	50	120	2.31	2.66
April	416	87	158	3.04	3.39
May	282	29	79.2	1.52	1.75
June	219	29	74.8	1.44	1.61
July 1 to 15	145	20	48.3	.929	.52

[a] Values for 1903 are rated as follows: September, excellent; October and November, good. December, fair.

[b] Ice conditions November 30 to December 12, December 17 to 19 and 27 to 31. Daily discharge estimated from observer's notes on ice thickness.

[c] Ice conditions; values approximate.

[d] Open channel.

[e] Values for 1904 are rated as follows: March to November, good; January, February, and December, approximate.

[f] Ice conditions January 1 to March 1 and December 7-31. Daily flow during ice period determined from observer's notes on ice thickness.

[g] Gage washed away September 14. Discharge September 15 to 17 estimated 700 second-feet on basis of flow at other stations in Raritan River drainage basin, and Passaic River drainage basin.

[h] Values for 1905 are rated as follows: April to December, good; March, fair; January and February, approximate.

[i] Ice conditions January 1 to 6, 15 to 18, and January 22 to March 10. Daily flow during ice period based upon observer's notes on ice thickness.

[j] Values for 1906 are rated as follows: January and March to July, good; February, approximate.

[k] River frozen February 2 to 19. Daily discharge estimated from observer's notes on ice thickness.

The following table gives the horsepower, 80 per cent efficiency, per foot of fall that may be developed at different rates of discharge and shows the number of days on which the flow and the corresponding horsepower were, respectively, less than the amounts given in the columns for "discharge" and "horsepower."

Discharge and horsepower table for North Branch Raritan River near Pluckemin, N. J.

Discharge in second-feet.	H. P. per foot fall; 80 per cent efficiency.	Number of days of deficient flow.			
		1903.[a]	1904.	1905.	1906.[b]
22	2	.....	1	36	2
33	3	.....	20	79	10
44	4	.....	58	110	21
55	5	14	108	173	50

[a] September 9 to December 31, 1903.
[b] January 1 to July 15, 1906.

RARITAN RIVER AT FINDERNE, N. J.

This station was established June 27, 1903. It is located at the highway bridge one-fourth mile from the Central Railroad of New Jersey station at Finderne, N. J. The conditions and the bench marks are described in Water-Supply Paper No. 167, page 71, where are given also references to publications that contain data for previous years.

The following discharge measurement was made May 2, 1906:

Width, 166 feet; area, 231 square feet; gage height, 4.27 feet; discharge, 563 second-feet.

Daily gage height, in feet, of Raritan River at Finderne, N. J., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July,	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.45	4.22	4.32	5.25	4.18	4.35	4.22	4.12	3.78	3.68	4.22	3.72
2	4.22	4.02	4.60	4.82	4.30	4.28	3.88	4.35	3.72	3.62	4.05	3.62
3	4.25	4.38	6.52	4.72	4.28	4.18	3.85	4.68	3.98	3.58	3.92	3.55
4	4.18	4.42	11.65	4.62	4.18	4.08	8.00	5.20	3.68	3.58	3.92	3.42
5	8.80	4.40	6.02	4.50	4.15	4.00	5.72	4.45	3.68	7.50	3.95	4.08
6	5.72	4.15	5.15	4.52	4.08	3.90	4.38	4.30	3.62	4.60	3.82	3.80
7	5.25	4.30	5.02	4.52	4.15	3.85	4.25	4.18	3.62	4.50	3.78	4.22
8	4.42	3.90	4.88	4.32	4.18	3.90	3.63	4.30	3.60	3.72	3.72	4.25
9	4.55	4.20	4.75	4.30	4.02	3.88	4.25	4.50	3.58	3.68	3.72	4.35
10	5.52	4.12	4.72	10.48	4.28	3.80	3.92	3.92	4.48	3.72	3.78	4.25
11	5.70	4.42	4.45	7.30	4.02	3.82	4.35	3.88	3.52	3.72	4.40	4.88
12	5.85	4.15	4.40	5.78	4.02	3.78	4.18	3.85	3.48	3.62	3.92	4.10
13	4.65	4.02	4.45	5.15	3.98	3.80	3.88	3.80	3.52	3.58	3.88	4.25
14	4.92	4.10	4.28	4.82	3.88	3.68	3.78	3.72	3.50	3.62	3.82	3.98
15	4.48	4.58	4.20	7.88	4.02	3.62	3.82	3.70	3.52	3.58	3.78	3.98
16	5.12	4.58	4.38	6.18	3.88	3.78	3.98	3.62	3.50	3.58	3.88	3.98
17	5.15	4.20	4.40	5.28	3.88	4.25	4.12	3.62	3.48	3.55	4.35	4.42
18	4.70	4.08	4.35	5.00	4.08	4.52	4.25	3.60	3.50	3.60	4.28	4.50
19	4.48	4.08	4.38	4.90	4.00	4.95	3.82	3.62	3.50	3.68	5.25	4.15
20	4.55	4.48	4.22	4.60	3.85	4.48	4.10	3.65	3.48	4.28	4.48	4.20
21	4.42	4.62	4.25	4.58	3.88	4.15	4.05	3.62	3.50	4.42	4.25	6.02
22	4.62	7.85	4.35	4.58	3.78	4.35	4.05	3.68	3.50	4.72	4.22	5.55
23	4.48	4.90	4.10	4.58	3.75	4.22	3.98	4.35	4.18	4.50	4.12	4.70
24	4.62	4.58	3.98	4.75	3.75	4.12	3.90	3.85	3.72	4.58	4.30	4.18
25	4.40	4.70	4.08	4.58	3.72	3.98	3.72	3.70	3.62	4.22	3.98	4.70
26	4.60	5.18	4.15	4.38	3.72	3.98	3.68	3.78	3.60	4.00	3.98	4.52
27	4.40	5.05	5.05	4.30	4.80	3.88	3.62	3.72	3.52	3.98	4.25	4.45
28	4.52	4.58	8.10	4.32	6.98	3.92	3.62	3.75	3.52	3.92	3.98	4.28
29	4.30	.....	6.40	4.12	5.80	3.92	4.95	3.82	3.50	3.98	4.25	4.20
30	4.18	.....	5.68	4.20	4.82	4.18	5.62	3.78	3.52	3.88	3.80	4.05
31	4.15	.....	5.95	.....	4.55	.....	4.42	3.80	.....	4.58	.....	5.22

NOTE.—No ice notes by observer; flow assumed to be unaffected by ice during the winter period.

Rating table for Raritan River at Finderne, N. J., for 1905 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.40	105	4.80	1,064	6.20	2,585	8.20	5,110
3.50	140	4.90	1,159	6.30	2,705	8.40	5,380
3.60	180	5.00	1,255	6.40	2,825	8.60	5,650
3.70	225	5.10	1,355	6.50	2,945	8.80	5,930
3.80	275	5.20	1,460	6.60	3,065	9.00	6,210
3.90	330	5.30	1,565	6.70	3,190	9.20	6,500
4.00	393	5.40	1,675	6.80	3,315	9.40	6,800
4.10	461	5.50	1,785	6.90	3,440	9.60	7,100
4.20	534	5.60	1,895	7.00	3,565	9.80	7,410
4.30	612	5.70	2,005	7.20	3,815	10.00	7,730
4.40	695	5.80	2,120	7.40	4,065	11.00	9,430
4.50	783	5.90	2,235	7.60	4,325	12.00	11,130
4.60	875	6.00	2,350	7.80	4,585		
4.70	969	6.10	2,465	8.00	4,845		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 14 discharge measurements made during 1903 to 1906, and is well defined between gage heights 3.9 feet and 10.0 feet. Above gage height 10.0 feet the rating curve is a tangent, the difference being 170 per tenth.

Monthly discharge of Raritan River at Finderne, N. J., for 1906.

[Drainage area, 490 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	5,930	197	1,150	2.35	2.71
February	4,650	330	843	1.72	1.79
March	10,500	380	1,490	3.04	3.50
April	8,550	476	1,490	3.04	3.39
May	3,540	235	616	1.26	1.45
June	1,210	189	449	.916	1.02
July	4,840	189	673	1.37	1.58
August	1,460	180	407	.831	.96
September	765	133	207	.422	.47
October	4,200	160	521	1.06	1.22
November	1,510	235	461	.941	1.05
December	2,370	112	673	1.37	1.58
The year	10,500	112	748	1.53	20.72

NOTE.—Values are rated as follows: January to December, excellent, except September, which is good. Flow probably not materially affected by ice during the winter months.

RARITAN RIVER AT BOUNDBROOK, N. J.

This station was established September 12, 1903. It is located at the highway bridge just back of the Lehigh Valley Railroad station at Boundbrook, N. J. The conditions and the bench marks are described in Water-Supply Paper No. 167, page 73, where are given also references to publications that contain data for previous years.

The following discharge measurement was made May 2, 1906:

Width, 357 feet; area, 983 square feet; gage height, 1.50 feet; discharge, 701 second-feet.

Daily gage height, in feet, of Raritan River at Boundbrook, N. J., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.75	1.6	1.85	2.7	1.5	1.75	1.45	1.45	1.2	1.5	2.35	1.4
2	1.7	1.45	1.85	2.25	1.45	1.6	1.35	1.55	1.2	1.5	1.8	1.3
3	1.6	1.3	2.95	2.05	1.6	1.55	1.25	2.3	1.2	1.45	1.7	1.3
4	5.4	1.45	8.8	1.9	1.55	1.45	4.05	3.05	1.2	1.5	1.55	1.15
5	3.9	1.3	5.3	2.0	1.5	1.4	2.45	2.4	1.2	3.1	1.5	1.35
6	2.85	1.3	2.95	1.85	1.5	1.4	2.15	1.9	1.2	2.05	1.5	1.4
7	2.15	1.2	2.45	1.8	1.55	1.35	1.8	1.6	1.15	1.8	1.5	1.75
8	2.0	1.2	2.45	1.7	1.55	1.3	1.55	1.5	1.15	1.65	1.4	1.6
9	1.9	1.5	2.23	1.8	1.5	1.3	1.45	1.6	1.15	1.5	1.45	1.6
10	2.0	1.5	2.05	7.62	1.6	1.3	1.5	1.6	1.1	1.45	1.45	1.5

Daily gage height, in feet, of Raritan River at Boundbrook, N. J., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	2.0	1.4	2.0	4.3	1.55	1.3	1.75	1.6	1.1	1.5	1.5	2.6
12	1.9	1.3	1.95	3.05	1.5	1.25	1.45	1.65	1.1	1.4	1.6	2.8
13	1.85	1.35	1.7	2.4	1.5	1.2	1.35	1.45	1.3	1.4	1.55	2.15
14	1.55	1.85	1.8	2.25	1.45	1.2	1.3	1.35	1.5	1.35	1.5	1.75
15	2.05	2.65	1.8	4.05	1.4	1.2	1.25	1.25	1.5	1.25	1.5	1.65
16	2.5	2.2	1.7	3.85	1.4	1.3	1.2	1.2	1.5	1.2	1.65	1.75
17	2.85	2.05	1.8	2.85	1.4	1.5	1.35	1.2	1.5	1.3	1.75	2.1
18	2.15	1.85	1.7	2.3	1.45	1.6	1.65	1.2	1.5	1.35	1.9	2.45
19	2.4	1.55	1.6	2.25	1.45	2.4	1.55	1.2	1.5	1.45	2.5	1.8
20	2.25	1.65	1.9	2.05	1.35	1.95	1.35	1.15	1.45	1.6	2.2	1.9
21	1.95	1.85	1.95	2.05	1.3	1.65	1.45	1.55	1.45	2.1	2.0	3.65
22	2.0	4.35	1.9	1.8	1.3	1.6	2.15	2.4	1.6	2.3	1.85	3.0
23	2.0	2.35	1.85	1.95	1.3	1.55	1.6	1.6	2.05	1.95	1.75	2.45
24	2.0	2.05	1.75	2.1	1.25	2.15	1.5	1.35	1.55	1.85	1.7	1.4
25	1.95	2.05	1.7	1.95	1.2	1.45	1.4	1.35	1.5	1.95	1.65	1.4
26	1.8	2.65	1.85	1.75	1.2	1.45	1.3	1.35	1.5	1.85	1.55	1.7
27	1.6	2.1	3.05	1.75	1.25	1.0	1.3	1.3	1.45	1.75	1.6	1.7
28	1.7	1.8	5.4	1.6	2.0	1.1	1.3	1.35	1.45	1.65	1.5	1.7
29	1.8	.....	4.1	1.65	4.15	1.25	1.9	1.35	1.5	1.5	1.4	1.8
30	1.55	.....	3.1	1.5	2.4	1.5	2.4	1.35	1.5	1.5	1.4	1.8
31	1.6	.....	3.2	.....	1.85	.....	1.85	1.25	.....	1.5	.....	2.5

NOTE.—River frozen February 4 to 12, December 4, 7 to 10, and 24 to 29.

Rating table for Raritan River at Boundbrook, N. J., for 1903 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	275	2.20	1,580	3.40	3,610	5.20	7,500
1.10	350	2.30	1,730	3.50	3,800	5.40	7,980
1.20	430	2.40	1,890	3.60	4,000	5.60	8,480
1.30	520	2.50	2,050	3.70	4,200	5.80	8,980
1.40	615	2.60	2,210	3.80	4,400	6.00	9,500
1.50	715	2.70	2,370	3.90	4,600	6.20	10,080
1.60	820	2.80	2,540	4.00	4,800	6.40	10,570
1.70	930	2.90	2,710	4.20	5,220	6.60	11,120
1.80	1,050	3.00	2,880	4.40	5,660	6.80	11,680
1.90	1,170	3.10	3,060	4.60	6,100	7.00	12,250
2.00	1,300	3.20	3,240	4.80	6,560	8.00	15,200
2.10	1,440	3.30	3,420	5.00	7,020	9.00	18,340

NOTE.—The above table is applicable only for open-channel conditions. It is based on 12 discharge measurements made during 1903 to 1906 and is well defined between gage heights 1.0 foot and 3.0 feet. The extension is based on one high-water measurement at gage height 7.35 feet.

Monthly discharge of Raritan River at Boundbrook, N. J., for 1906.

[Drainage area, 800 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	7,980	767	1,630	2.04	2.35
February[a]	5,550	430	1,170	1.46	1.52
March	17,700	820	2,560	3.20	3.69
April	14,100	715	2,190	2.74	3.06
May	5,110	430	866	1.08	1.24
June	1,890	275	706	.882	.98
July	4,900	430	960	1.20	1.38
August	2,970	390	831	1.04	1.20
September	1,370	350	603	.754	.84
October	3,060	430	917	1.15	1.33
November	2,050	615	926	1.16	1.29
December	4,100	390	1,240	1.55	1.79
The year	17,700	275	1,220	1.52	20.67

[a] Discharge applied during frozen period as if open channel conditions existed.

NOTE.—Values are rated as follows: January, and March to November, good; February and December, fair.

DELAWARE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Delaware River rises in Delaware, Greene, and Schoharie counties, N. Y., the source of the main stream, which is commonly known as West Branch, to distinguish it from the smaller East or Pepacton Branch, being a small lake almost on the line of Schoharie and Delaware counties, at an elevation of 1,886 feet above tide. From this lake it flows southwestward across central Delaware County to Deposit, where it receives Oquaga Creek, a large tributary draining eastern Broome County, and turns abruptly to the southeast, forming the boundary line between New York and Pennsylvania until Port Jervis is reached. Here it turns again to the southwest and flows for a distance of about 40 miles along the base of the Shawangunk Range until it passes through the water gap, from which point it flows irregularly southward to Trenton. Below Trenton the course is in general southwestward to Delaware Bay. South of Port Jervis it forms the dividing line between Pennsylvania and New Jersey, and for a few miles between Delaware and New Jersey.

East Branch rises at Grand Gorge, in northeastern Delaware County, and flows parallel to West Branch across southern Delaware County, uniting with the latter stream at Hancock.

The total length of the river from the mouth to the head of West Branch is about 410 miles; its drainage area, measured at Philadelphia and including Schuylkill River, is 10,100 square miles, of which about 2,580 square miles lie in New York, 5,720 in Pennsylvania, and 1,800 in New Jersey. The river is tidal to Trenton, which lies also at the head of navigation.

The Delaware receives a number of important tributaries, among which may be mentioned Mongaup and Neversink rivers and Callicoon Creek from New York; Lackawaxen, Lehigh, and Schuylkill rivers and numerous creeks from Pennsylvania, and Rancocas Creek, Musconetcong River, and Maurice River from New Jersey.

Measurements of the flow of Delaware River were made during the last half of June, 1891, by Prof. Dwight Porter and students at Delaware Watergap, Pa. The results show a flow from 2,000 to 2,200 second-feet. This was said to be the lowest June stage for five years. Measurements were made during the drought of 1895 by Prof. L. M. Haupt at Point Pleasant, Pa., near the intake of the Delaware and Raritan Canal feeder. The discharge above the bridge was 1,657 second-feet and below the bridge 1,328 second-feet. The discharge was measured by E. G. Paul June 4, 1899, at Martins Creek, Pa., 7 miles above the mouth of Lehigh River, and found to be 2,724 second-feet.

WEST BRANCH DELAWARE RIVER AT HANCOCK, N. Y.

This station was established October 15, 1902. It is located one-half mile west of the Erie Railroad station at Hancock, N. Y., and about 1 mile above the mouth of East Branch. The conditions and the bench marks are described in Water-Supply Paper No. 167, page 78, where are given also references to publications that contain data for previous years.

Information in regard to this station is contained in the annual reports of the State engineer and surveyor of New York.

Discharge measurements of West Branch Delaware River at Hancock, N. Y., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft*
March 29	Horton and Mott	243	949	5.50	3,620
March 31	do	250	1,080	6.10	5,080
April 12	Covert and Weeks	248	1,080	6.15	4,900
April 13	do	243	1,040	5.90	4,280
July 25	C. C. Covert	196	349	3.22	315
October 6	do	200	335	3.02	235

Daily gage height, in feet, of West Branch Delaware River at Hancock, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.70	4.00	3.80	5.40	3.60	4.00	4.25	3.28	3.40	3.20	4.00	3.80
2	3.65	3.70	3.88	5.15	3.45	3.90	3.78	3.12	3.20	3.20	3.85	3.40
3	3.40	4.55	4.00	4.90	3.75	3.80	3.60	3.22	3.30	3.10	3.80	3.75
4	5.40	4.55	8.30	4.30	3.88	3.60	3.75	3.25	3.18	3.02	3.70	4.95
5	5.45	5.00	5.75	5.80	3.70	3.58	3.75	3.20	3.20	3.00	3.62	4.85
6	4.35	4.90	5.00	6.30	3.60	4.80	3.50	3.12	3.08	2.98	3.52	5.60
7	3.75	4.80	4.75	5.80	3.52	4.55	3.45	3.32	3.05	3.02	3.40	5.50
8	3.55	4.95	4.48	5.45	3.60	4.30	3.30	4.38	3.02	3.05	3.32	4.00
9	3.30	5.00	4.40	5.20	3.55	4.05	3.28	3.60	3.05	3.05	3.35	3.95
10	4.35	4.85	4.30	6.25	3.68	4.40	3.30	3.42	3.00	3.05	3.20	4.70
11	4.25	4.75	4.05	6.90	3.62	4.50	3.35	3.30	2.98	3.00	3.20	4.55
12	4.72	4.85	3.85	6.20	3.55	4.15	3.30	3.10	2.88	3.08	3.50	4.10
13	5.05	4.80	3.82	5.80	3.55	3.95	3.15	3.20	2.85	3.08	3.45	4.10
14	4.85	4.75	3.70	5.65	3.62	3.80	3.15	3.10	2.82	2.95	3.42	4.10
15	4.50	4.65	3.75	7.25	3.62	3.70	3.02	3.05	2.82	3.05	3.25	4.02
16	4.35	4.45	3.55	7.60	3.55	4.62	3.10	3.00	2.78	3.00	3.20	4.60
17	4.20	4.40	3.65	6.45	3.42	6.92	3.08	2.95	2.68	2.95	3.25	4.45
18	4.10	4.40	3.30	5.85	3.65	6.35	3.35	2.90	2.70	2.90	3.58	4.10
19	3.90	4.50	3.85	5.35	3.72	5.70	3.35	2.95	2.62	2.95	6.30	3.60
20	3.70	4.35	3.40	5.15	3.60	5.28	3.15	2.80	2.85	3.80	5.50	3.55
21	3.80	4.45	3.55	4.85	3.50	4.85	3.12	3.65	3.38	4.70	5.35	4.35
22	5.35	6.55	3.50	4.70	3.45	4.55	3.05	3.40	3.08	4.20	5.20	4.20
23	5.38	5.00	3.35	4.55	3.38	4.42	3.20	3.35	3.65	4.05	4.82	3.85
24	6.70	4.75	4.00	4.30	3.40	4.30	3.30	3.18	3.25	3.90	4.55	3.05
25	5.60	5.10	3.78	4.25	3.35	4.02	3.20	3.15	3.20	3.95	4.35	3.20
26	5.00	5.60	3.60	4.05	3.25	3.82	3.12	3.08	3.05	4.20	4.30	3.75
27	4.80	4.50	4.10	3.98	3.35	3.75	3.18	3.30	3.08	3.95	4.20	4.40
28	4.50	3.90	7.85	3.85	4.00	3.65	2.90	4.58	3.15	3.92	4.05	4.45
29	4.20	.....	5.60	3.78	4.70	3.70	3.02	4.22	2.98	4.02	3.95	4.20
30	4.10	.....	5.45	3.70	4.35	3.60	3.20	3.80	3.00	3.82	3.85	4.20
31	4.10	.....	6.20	.....	4.10	.....	3.35	3.55	.....	3.98	.....	5.30

NOTE.—River obstructed by ice January 3 to March 2; clear channel from March 3 to 19, approximately; more or less obstructed by ice and needle ice from the latter date to March 28.

The river seldom freezes solid at the gage and all readings are to water surface, a channel about 10 feet wide near the left bank being kept open by oil and hot water from a pumping station one-half mile above the gage.

There is considerable needle ice in the stream the greater part of the frozen period, making the discharge very uncertain. Attempts to make meter measurements here in 1904-5 were unsuccessful on this account. Needle ice forming on the rifts a few hundred feet below the gage during the frozen period often causes backwater.

Rating table for West Branch Delaware River at Hancock, N. Y., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.60	100	3.70	695	4.80	2,130	5.90	4,440
2.70	130	3.80	790	4.90	2,300	6.00	4,700
2.80	165	3.90	890	5.00	2,470	6.20	5,230
2.90	205	4.00	1,000	5.10	2,650	6.40	5,780
3.00	245	4.10	1,120	5.20	2,840	6.60	6,340
3.10	290	4.20	1,250	5.30	3,040	6.80	6,920
3.20	340	4.30	1,380	5.40	3,250	7.00	7,510
3.30	400	4.40	1,520	5.50	3,470	7.20	8,120
3.40	465	4.50	1,660	5.60	3,700	7.40	8,740
3.50	535	4.60	1,810	5.70	3,940	7.60	9,380
3.60	610	4.70	1,970	5.80	4,190		

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1906 and other measurements made during previous years. It is fairly well defined.

Monthly discharge of West Branch Delaware River at Hancock, N. Y., for 1906.

[Drainage area, 680 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April	9,380	695	3,440	5.06	5.64
May	1,970	370	684	1.01	1.16
June	7,270	595	1,670	2.46	2.74
July	1,320	205	432	.635	.73
August	1,780	165	484	.712	.82
September	652	106	277	.407	.45
October	1,970	205	574	.844	.97
November	5,500	340	1,180	1.74	1.94
December	3,700	267	1,390	2.04	2.35

NOTE.—Values are rated as follows: April to November, good; ice conditions for December not known, rated as fair.

EAST BRANCH DELAWARE RIVER AT HANCOCK, N. Y.

This station was established October 14, 1902. It is located at the highway bridge one-half mile southeast of the Erie Railroad station at Hancock, N. Y., and 1 mile above the junction with West Branch of the Delaware. The Erie Railroad bridge is just below the station. The conditions at the station and the bench marks are described in Water-Supply Paper No. 167, page 81, where are given also references to publications that contain data for previous years.

Information in regard to this station is contained in the annual reports of the State engineer and surveyor of New York.

Discharge measurements of East Branch Delaware River at Hancock, N. Y., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 29	Horton and Mott	335	1,150	4.88	4,010
March 31	do	337	1,400	5.68	5,650
April 12	Covert and Weeks	337	1,560	6.10	7,400
April 13	do	339	1,410	5.78	6,140
July 26	C. C. Covert	274	669	3.40	855
October 6	do	260	490	2.90	343

Daily gage height, in feet, of East Branch Delaware River at Hancock, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.58	3.92	7.95	5.05	3.68	4.35	3.60	3.30	3.35	3.12	3.92	3.75
2	3.52	3.70	10.70	4.85	3.60	4.22	3.45	3.18	3.25	3.02	3.80	3.68
3	3.42	3.05	10.65	4.62	3.75	4.05	3.40	3.22	3.25	2.92	3.70	3.52
4	4.28	3.85	10.00	4.75	3.75	3.85	3.55	3.45	3.35	2.88	3.60	4.25
5	4.42	3.95	6.05	5.55	3.62	3.78	3.60	3.35	3.18	2.90	3.52	4.70
6	3.90	4.10	5.05	6.28	3.60	4.50	3.42	3.25	3.10	2.90	3.50	5.00
7	3.65	4.35	4.80	5.60	3.60	4.40	3.28	3.25	3.02	2.95	3.42	5.10
8	3.45	4.35	4.45	5.30	3.62	4.15	3.20	3.40	3.00	3.08	3.40	3.90
9	3.40	4.75	4.35	5.15	3.65	3.98	3.12	3.38	2.95	2.95	3.32	3.90
10	3.25	4.60	4.25	5.80	4.05	5.85	3.12	3.22	2.90	2.95	3.30	4.20
11	3.68	4.80	3.95	7.05	3.85	5.58	3.20	3.18	2.90	3.00	3.35	4.45
12	4.22	4.70	3.95	6.15	3.75	4.88	3.15	2.10	2.85	3.05	3.48	4.10
13	4.85	4.75	3.75	5.75	3.70	4.48	3.08	3.02	2.80	3.02	3.50	4.10
14	4.05	4.65	3.72	5.70	3.70	4.25	3.00	3.00	2.80	2.98	3.40	4.05
15	3.75	4.50	3.70	8.37	3.65	4.05	2.98	2.92	2.78	2.92	3.32	3.90
16	3.65	4.40	3.45	8.40	3.58	4.32	2.92	2.90	2.75	2.90	3.30	4.45
17	3.68	4.25	3.65	6.65	3.50	4.65	2.95	2.85	2.70	2.90	3.48	4.15
18	3.58	4.22	3.50	5.95	3.82	5.00	3.08	2.80	2.70	2.85	3.38	3.95
19	3.50	4.28	3.50	5.48	3.90	4.75	3.05	2.80	2.70	2.85	6.10	3.55
20	3.55	4.28	3.65	5.22	3.75	4.60	3.00	2.85	2.75	4.85	5.70	3.70
21	3.48	4.30	3.58	4.95	3.62	4.35	4.40	3.45	3.05	4.80	5.40	4.15
22	4.55	5.05	3.60	4.75	3.55	4.20	3.80	3.78	3.15	4.25	5.25	3.95
23	5.10	4.60	3.40	4.58	3.50	4.08	3.70	3.45	3.20	3.95	4.85	3.70
24	7.10	4.30	3.45	4.45	3.42	3.98	3.80	3.25	3.15	8.78	4.55	3.55
25	5.60	4.50	3.50	4.28	3.38	3.78	3.60	3.25	2.95	4.12	4.42	4.30
26	5.00	5.15	3.50	4.15	3.32	3.65	3.40	3.10	2.88	4.60	4.25	4.70
27	4.72	4.30	3.62	4.05	3.30	3.55	3.30	3.32	2.90	4.25	4.10	5.00
28	4.55	4.75	6.60	3.88	4.80	3.45	3.22	4.58	2.90	4.30	4.02	5.10
29	4.30	.....	5.05	3.80	5.35	3.48	3.30	4.00	2.88	4.15	3.92	4.90
30	4.10	.....	5.00	3.72	4.85	3.38	3.30	3.65	2.88	4.00	3.75	4.35
31	4.05	.....	5.60	.....	4.55	.....	3.55	3.52	.....	4.00	.....	4.50

NOTE.—Channel full of needle ice during greater part of January; river frozen February 1 to 22, ice 0.3 to 0.75 foot thick; open February 22 and 23, also after March 4, although there was considerable anchor and needle ice until about March 27. Some anchor ice during December.

Rating table for East Branch Delaware River at Hancock, N. Y., for 1906.

Gage height.	Discharge.	Gage height.	Discharge	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.70	225	3.90	1,610	5.10	4,215	6.60	8,730
2.80	285	4.00	1,780	5.20	4,475	6.80	9,460
2.90	355	4.10	1,960	5.30	4,740	7.00	10,210
3.00	440	4.20	2,150	5.40	5,010	7.20	10,980
3.10	540	4.30	2,350	5.50	5,285	7.40	11,760
3.20	650	4.40	2,560	5.60	5,565	7.60	12,560
3.30	770	4.50	2,780	5.70	5,850	7.80	13,360
3.40	890	4.60	3,000	5.80	6,140	8.00	14,200
3.50	1,020	4.70	3,230	5.90	6,435	8.20	15,040
3.60	1,160	4.80	3,470	6.00	6,735	8.40	15,920
3.70	1,300	4.90	3,710	6.20	7,365		
3.80	1,450	5.00	3,960	6.40	8,025		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 15 discharge measurements made during 1904–1906, and is fairly well defined between gage heights 2.9 feet and 7.5 feet.

Monthly discharge of East Branch Delaware River at Hancock, N. Y., for 1906.

[Drainage area, 920 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April	15,900	1,330	5,260	5.72	6.38
May	4,880	770	1,540	1.67	1.92
June	6,290	866	2,390	2.60	2.90
July	2,560	372	852	.926	1.07
August	2,960	295	801	.871	1.00
September	830	225	436	.474	.53
October	3,530	320	1,140	1.24	1.43
November	7,040	770	1,960	2.13	2.38
December	4,220	1,050	2,270	2.47	2.85

NOTE.—Values are rated as follows: April to November, good; December, fair.

DELAWARE RIVER AT RIEGELSVILLE, N. J.

This station was established July 3, 1906. It is located at the toll bridge connecting Riegelsville, N. J., and Riegelsville, Pa. The Musconetcong enters the Delaware 600 or 700 feet below the station.

The channel is straight for one-half mile above and one-fourth mile below the station. Both banks are steep and wooded and will not overflow except in extreme flood. The bed of the stream is composed of gravel and bowlders. It may shift somewhat near the piers. The depth of water is 12 to 15 feet at ordinary stages.

Discharge measurements are made from the suspension bridge to which the gage is attached. The initial point for soundings is the face of the left abutment.

The chain gage, which was read during 1906 by John H. Deemer, is attached to the hand rail in the middle span, 20 feet from the east pier; length of chain, 43.67 feet. The bench mark is on the top of the steel part of the downstream cable anchorage at the left bank; elevation, 39.76 feet above the gage datum.

The following measurement was made July 3, 1906:

Width, 492 feet; area, 4,440 square feet; gage height, 4.52 feet; discharge, 8,550 second-feet.

Daily gage height, in feet, of Delaware River at Riegelsville, N. J., for 1906.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		4.12	3.42	2.45	4.78	4.18	17	3.10	2.89	2.16	2.54	3.56	4.86
2		3.89	3.20	2.44	4.56	3.96	18	3.10	2.71	2.21	2.46	3.48	5.36
3	4.45	3.88	3.12	2.50	4.44	4.08	19	3.05	2.70	2.29	2.42	4.55	4.51
4	5.44	4.81	3.32	2.59	4.20	3.59	20	3.05	2.60	2.19	2.49	7.44	4.19
5	5.50	4.60	3.18	3.20	4.08	3.31							
							21	3.01	2.78	2.32	4.90	7.72	4.86
6	5.14	4.18	3.12	3.28	3.94	3.66	22	3.42	2.92	2.30	6.42	7.10	5.15
7	4.68	3.99	2.96	2.90	3.84	4.08	23	4.08	3.05	3.54	5.35	6.74	5.25
8	4.26	3.72	2.80	2.85	3.70	5.16	24	4.18	3.48	3.71	4.75	6.06	4.28
9	3.99	3.69	2.68	2.85	3.58	4.66	25	4.06	3.42	2.64	4.76	5.46	3.51
10	3.96	4.02	2.65	2.78	3.55	4.38							
							26	3.80	3.18	2.65	5.62	5.19	3.62
11	3.90	3.82	2.51	2.72	3.41	4.58	27	3.52	3.28	2.64	5.76	4.95	3.68
12	3.78	3.65	2.45	2.72	3.55	4.54	28	3.40	3.66	2.52	5.29	4.69	3.92
13	3.60	3.46	2.52	2.68	3.61	4.59	29	3.58	3.60	2.45	5.10	4.42	4.22
14	3.45	3.24	2.42	2.58	3.75	4.58	30	3.70	4.25	2.48	4.86	4.34	4.38
15	3.22	3.12	2.30	2.55	3.66	4.50	31	3.98	3.82		5.01		5.38
16	3.15	2.98	2.20	2.64	3.76	4.58							

DELAWARE RIVER AT LAMBERTVILLE, N. J.

This station was established July 22, 1897. It is located at the toll bridge at Lambertville, N. J. The conditions and the bench marks are described in Water-Supply Paper No. 167, page 85, where are given also references to publications that contain data for previous years.

Discharge measurements of Delaware River at Lambertville, N. J., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 1[a]	Robert Follansbee	982	5,760	5.16	11,600
July 4[a]	do	.....	5,800	5.36	12,000
December 5[abc]	N. C. Grover	945	4,990	4.75	4,910

[a] Discharge of canal not included. [b] Discharge of canal 443 second-feet.
[c] Discharge affected by ice conditions.

Daily gage height, in feet, of Delaware River at Lambertville, N. J., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.0	5.05	5.45	8.1	4.95	5.35	4.45	4.55	4.2	2.65	5.05	4.7
2	4.9	4.8	5.0	7.55	4.9	5.15	4.3	4.45	3.95	2.7	5.0	4.6
3	4.6	4.85	5.45	6.95	4.8	4.95	4.35	4.6	3.85	2.6	4.9	4.6
4	5.55	4.7	11.1	6.55	4.8	4.75	5.35	5.1	3.7	2.8	4.8	4.5
5	5.65	.....	11.8	6.4	4.75	4.55	5.25	5.0	3.9	4.65	4.8	4.1
6	5.35	.....	8.8	7.05	4.75	4.4	4.95	4.75	3.75	4.15	4.55	4.15
7	5.55	.....	7.2	7.85	4.7	4.75	4.75	4.55	3.55	3.8	4.4	4.4
8	5.2	.....	6.65	7.2	4.6	4.95	4.45	4.3	3.35	3.55	4.35	5.3
9	4.8	.....	6.2	6.85	4.65	4.9	4.2	4.25	3.2	3.4	4.3	5.1
10	4.65	.....	6.05	8.35	4.75	4.85	4.1	4.3	3.0	3.25	4.25	4.75
11	4.6	.....	5.95	9.4	4.75	4.8	4.05	4.45	2.85	3.2	4.2	4.75
12	4.5	.....	5.5	9.55	4.6	5.1	3.95	4.3	2.75	3.15	4.3	5.1
13	4.9	4.1	5.4	8.25	4.55	4.95	3.75	4.1	2.7	3.1	4.35	4.85
14	4.9	4.25	5.25	7.65	4.5	4.6	3.65	3.8	2.7	3.1	4.4	4.85
15	4.9	4.35	4.95	8.5	4.4	4.35	3.5	3.7	2.5	3.0	4.35	4.8
16	5.05	4.15	4.85	13.2	4.4	4.15	3.4	3.45	2.5	3.0	4.45	4.8
17	5.05	4.1	4.75	11.4	4.35	4.15	3.4	3.3	2.45	2.9	4.35	5.05
18	4.8	4.05	4.65	9.1	4.3	4.95	3.45	3.15	2.4	2.8	4.35	5.2
19	4.85	3.9	4.85	8.1	4.25	6.9	3.4	3.1	2.4	2.7	4.85	5.0
20	4.75	4.1	4.55	7.25	4.55	7.15	3.4	3.1	2.3	2.85	5.9	4.9
21	4.6	4.3	4.4	6.95	4.35	6.15	3.65	3.05	2.35	4.85	6.7	5.1
22	4.7	6.65	4.45	6.6	4.15	6.05	3.85	3.45	2.55	5.9	6.3	5.35
23	4.85	6.15	4.45	6.05	4.1	5.95	4.45	3.5	2.75	5.45	6.1	5.35
24	6.2	6.3	4.35	6.1	4.05	5.65	4.65	3.9	3.1	5.2	5.8	5.0
25	7.5	6.15	4.3	6.05	3.95	5.25	4.55	4.1	3.05	5.0	5.45	4.6
26	6.85	6.6	4.3	5.85	3.8	4.95	4.45	3.95	2.9	5.0	5.25	4.5
27	6.0	6.85	4.5	5.65	3.9	4.7	4.25	3.85	3.05	5.6	5.05	4.5
28	5.8	6.0	5.9	5.35	4.3	4.45	4.05	4.05	2.95	5.45	4.95	4.4
29	5.65	.....	8.25	5.4	6.25	4.3	4.15	4.3	2.7	5.25	4.85	4.45
30	5.25	.....	7.75	5.05	6.45	4.3	4.25	4.4	2.7	5.1	4.7	4.6
31	5.2	.....	7.6	.....	6.1	.....	4.35	4.5	.....	4.95	.....	5.35

NOTE.—River frozen, February 5 to 12; also probably more or less ice conditions during December.

MUSCONETCONG RIVER NEAR BLOOMSBURY, N. J.

This station was established July 4, 1903. It is located at the first highway bridge over Musconetcong River above the village of Bloomsbury, N. J. The conditions and the bench marks are described in Water-Supply Paper No. 166, page 86, where are given also references to publications that contain data for previous years.

The following discharge measurement was made May 4, 1906:

Area, 116 square feet; gage height, 1.67 feet; discharge, 253 second-feet.

Daily gage height, in feet, of Musconetcong River near Bloomsbury, N. J., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.42	1.35	1.67	2.25	1.82	1.98	1.48	1.82	1.18	1.15	1.28	1.15
2	1.33	1.35	1.48	2.10	1.75	1.98	1.30	1.82	1.15	1.20	1.20	1.12
3	1.30	1.15	2.80	1.98	1.92	1.98	1.25	2.00	1.25	1.10	1.22	1.25
4	1.87	1.32	3.75	1.92	1.62	1.90	1.45	1.92	1.22	1.12	1.10	1.18
5	1.68	1.30	2.65	1.90	1.40	1.72	1.38	1.88	1.18	1.58	1.15	1.28
6	1.57	1.13	2.15	1.95	1.38	1.68	1.28	1.85	1.18	1.30	1.10	1.35
7	1.48	1.20	1.95	1.90	1.42	1.60	1.22	1.70	1.02	1.18	1.02	1.38
8	1.48	1.30	1.90	1.85	1.45	1.52	1.20	1.65	1.08	1.18	1.15	1.48
9	1.35	1.25	1.82	1.92	1.55	1.50	1.22	1.60	.92	1.15	.90	1.18
10	1.40	1.27	1.70	2.90	1.55	1.42	1.30	1.55	1.12	1.12	1.08	1.28
11	1.37	1.23	1.70	2.75	1.40	1.35	1.35	1.52	1.10	1.15	1.08	1.65
12	1.47	1.25	1.65	2.55	1.38	1.28	1.28	1.52	1.12	1.15	1.22	1.22
13	1.50	1.22	1.58	2.35	1.38	1.22	1.22	1.50	1.08	1.12	1.12	1.32
14	1.50	1.28	1.52	2.28	1.38	1.20	1.15	1.48	.95	1.05	1.18	1.28
15	1.43	1.25	1.50	2.75	1.40	1.20	1.12	1.45	.90	1.10	1.15	1.35
16	1.57	1.38	1.50	2.80	1.35	1.28	1.18	1.40	1.02	1.12	1.15	1.42
17	1.58	1.27	1.50	2.72	1.35	1.70	1.15	1.40	1.12	1.12	1.12	1.48
18	1.52	1.20	1.48	2.50	1.40	1.48	1.32	1.35	1.12	1.12	1.25	1.42
19	1.48	1.25	1.50	2.32	1.45	1.70	1.25	1.32	1.10	1.00	1.62	1.28
20	1.42	1.30	1.50	2.25	1.38	1.52	1.18	1.28	1.12	1.32	1.55	1.35
21	1.42	1.82	1.55	2.12	1.32	1.42	1.18	1.35	1.15	1.42	1.42	1.65
22	1.47	3.12	1.62	2.05	1.28	1.52	1.30	1.30	1.15	1.38	1.35	1.48
23	1.47	2.08	1.55	2.05	1.28	1.58	1.28	1.28	1.10	1.25	1.25	1.45
24	1.75	1.87	1.55	2.18	1.25	1.65	1.22	1.32	1.10	1.20	1.22	1.32
25	1.62	1.80	1.53	2.10	1.20	1.48	1.18	1.20	1.10	1.22	1.20	1.45
26	1.48	1.82	1.57	2.08	1.22	1.48	1.15	1.22	1.05	1.20	1.20	1.45
27	1.40	1.68	2.02	1.92	1.20	1.42	1.15	1.22	1.10	1.20	1.20	1.32
28	1.43	1.32	2.58	1.85	1.78	1.35	1.20	1.32	1.15	1.12	1.22	1.32
29	1.40	.....	2.35	1.90	2.98	1.32	1.75	1.35	1.08	1.18	1.22	1.30
30	1.37	.....	2.23	1.92	2.98	1.32	2.20	1.30	1.15	1.15	1.22	1.32
31	1.38	.....	2.25	.....	2.20	.....	1.88	1.28	.....	1.18	.....	2.18

NOTE.—River two-thirds frozen over February 6 to 7 and 16 and December 24 to 28.

Rating table for Musconetcong River near Bloomsbury, N. J., for 1903 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	56	1.70	251	2.50	538	3.20	821
1.00	69	1.80	283	2.60	578	3.30	862
1.10	86	1.90	317	2.70	618	3.40	903
1.20	107	2.00	352	2.80	658	3.50	945
1.30	132	2.10	388	2.90	698	3.60	987
1.40	160	2.20	424	3.00	739	3.70	1,030
1.50	190	2.30	461	3.10	780	3.80	1,073
1.60	220	2.40	499				

NOTE.—The above table is applicable only for open-channel conditions. It is based on 9 discharge measurements made during 1903 to 1906, and is well defined between gage heights 1.0 foot and 2.9 feet.

Monthly discharge of Musconetcong River near Bloomsbury, N. J., for 1906.

[Drainage area 146 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	807	182	184	1.26	1.45
February	788	92	185	1.27	1.32
March	1,050	184	319	2.18	2.51
April	698	300	429	2.94	3.28
May	731	107	217	1.49	1.72
June	345	107	200	1.37	1.53
July	424	90	141	.966	1.11
August	352	107	189	1.29	1.49
September	119	56	87.8	.601	.67
October	214	69	107	.733	.85
November	226	56	111	.760	.85
December	417	90	156	1.07	1.23
The year	1,050	56	194	1.33	18.01

NOTE.—Values are rated as follows: January to March and December, good; April to November, excellent. No corrections made in estimates of flow under ice conditions; flow not considered to be materially affected by ice.

TOHICKON CREEK AT POINT PLEASANT, PA.

Measurements of the discharge of Tohickon Creek are made near its mouth at Point Pleasant. Gage heights are furnished by John E. Codman, hydrographer of the water department of Philadelphia. The conditions at the station and the bench marks are described in Water-Supply Paper No. 166, page 89, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Tohickon Creek at Point Pleasant, Pa., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	76.4	79.0	109.0	368.5	38.8	50.0	15.8	25.7	*14.6*	*3.5*	324.5	30.6
2	*57.9*	*57.5*	75.6	157.0	27.2	38.8	18.1	22.2	10.2	4.7	186.0	*21.4*
3	80.5	61.2	1,557.7	105.5	26.8	23.7	26.8	25.2	7.0	6.6	59.8	25.7
4	*1,359.3*	74.7	*2,933.8*	80.5	26.4	20.0	*611.0*	*723.1*	8.6	5.2	43.8	23.1
5	701.8	71.0	657.7	72.5	22.3	21.4	157.2	267.7	5.2	*133.1*	34.8	26.0
6	232.0	71.0	210.0	68.9	20.1	17.5	63.6	57.2	10.3	46.5	31.4	31.8
7	111.0	71.0	147.5	65.5	24.6	19.2	41.6	31.9	11.1	31.5	26.3	101.0
8	75.8	71.0	153.5	58.7	26.8	20.9	32.3	22.3	7.2	23.1	21.7	60.5
9	75.8	71.0	167.5	664.4	28.8	14.5	32.3	25.3	6.3	17.6	23.1	61.2
10	111.0	79.0	142.0	*3,196.4*	32.6	9.7	26.1	29.0	3.1	13.3	18.8	51.6
11	170.5	79.0	104.0	719.0	30.6	14.4	13.2	27.9	4.3	12.5	*14.5*	201.0
12	205.5	71.0	83.5	291.0	27.6	17.1	12.9	21.5	3.0	9.7	48.5	108.9
13	201.0	64.5	75.5	155.0	18.4	12.9	13.4	19.7	6.5	9.7	38.0	51.9
14	249.5	124.0	67.6	80.3	12.6	11.0	12.2	21.1	2.8	8.2	36.5	67.8
15	272.0	182.5	58.7	1,719.9	22.0	10.1	10.9	15.7	4.6	8.8	29.5	48.7
16	510.5	141.0	65.0	1,210.5	18.9	8.4	9.8	10.3	4.9	8.6	35.9	73.4
17	505.5	97.0	71.2	338.5	15.2	*7.0*	14.5	9.8	*2.8*	5.5	41.6	448.2
18	210.0	75.6	65.5	130.0	15.2	267.9	21.8	9.8	3.1	7.7	473.3	427.0
19	168.0	70.6	57.1	102.5	16.9	*1,002.5*	20.1	*5.9*	4.3	8.2	*823.5*	122.2
20	133.5	448.2	59.8	79.0	13.1	459.8	12.4	6.2	5.9	25.0	359.5	337.2
21	137.5	978.3	71.0	64.5	10.7	54.3	8.6	7.5	5.1	76.5	145.5	821.5
22	172.0	*1,765.1*	60.7	55.1	9.9	87.0	*5.2*	13.8	4.5	103.0	89.0	527.0
23	166.0	446.8	55.4	52.2	10.5	83.5	7.9	35.6	3.9	77.5	64.5	226.3
24	475.5	253.5	51.2	51.3	9.2	64.3	7.9	21.0	4.2	53.4	53.4	48.7
25	229.5	390.5	*43.5*	49.5	*4.4*	48.7	8.6	11.9	7.2	77.9	43.6	48.7
26	102.0	426.0	54.6	44.3	7.1	43.8	8.6	9.4	3.8	112.5	39.0	48.7
27	77.0	163.0	1,302.9	39.5	20.5	30.0	6.3	13.4	4.6	83.0	39.0	48.7
28	204.5	101.0	2,689.0	39.0	222.8	22.0	8.1	22.3	5.3	42.5	34.8	48.7
29	237.5	.....	956.2	*29.7*	*943.9*	17.6	7.7	24.9	3.9	33.4	31.0	59.8
30	110.0	.....	394.0	33.7	301.0	19.1	44.8	21.8	4.2	31.0	31.0	67.6
31	85.0	.....	599.1	.....	75.0	.....	33.9	14.6	.....	39.2	.....	*1,863.4*

NOTE.—Italic figures indicate maximum and minimum.

Monthly discharge of Tohickon Creek at Point Pleasant, Pa., for 1906.

[Drainage area, 102 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	1,360	57.9	242	2.37	2.73
February	1,760	57.5	235	2.30	2.40
March	2,980	43.5	424	4.16	4.80
April	3,200	29.7	337	3.30	3.68
May	944	4.4	67.1	.658	.76
June	1,000	7.0	83.9	.823	.92
July	611	5.2	42.4	.416	.48
August	723	5.9	50.7	.497	.57
September	14.6	2.8	5.8	.056	.06
October	138	3.5	36.3	.356	.41
November	824	14.5	106	1.04	1.16
December	1,860	21.4	198	1.94	2.24
The year	3,200	2.8	152	1.49	20.21

NESHAMINY CREEK AT FORKS, PA.

This station is located at the forks of Big and Little Neshaminy creeks. The table of daily discharge for 1906 was furnished by John E. Codman, hydrographer of the Philadelphia water department. The conditions at the station and the bench marks are described in Water-Supply Paper No. 166, page 90, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Neshaminy Creek at forks, Pa., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	125.5	134.0	233.5	362.0	84.5	81.0	217.0	66.5	59.0	*18.5*	414.0	71.0
2	107.0	111.5	147.5	242.0	81.5	68.0	210.5	268.3	46.5	18.5	376.0	*62.0*
3	126.5	135.0	2,048.5	198.0	81.5	59.0	1,048.2	*1,502.1*	44.5	21.5	134.0	62.0
4	*1,539.4*	150.0	*3,050.2*	175.5	80.0	54.0	*2,786.2*	318.5	43.5	23.5	114.0	86.0
5	496.7	106.5	540.5	166.0	209.5	47.5	357.0	128.5	35.0	28.5	99.0	87.0
6	267.5	88.0	327.5	162.0	236.5	41.0	250.0	134.5	38.5	*2,412.5*	94.0	108.0
7	200.5	88.0	272.5	152.0	133.0	44.5	148.5	113.5	42.0	259.5	82.5	116.0
8	171.0	*80.0*	279.0	135.5	114.5	44.5	127.0	103.5	36.5	128.5	75.0	91.0
9	154.0	157.0	267.5	828.0	96.0	38.5	124.5	105.0	31.0	98.0	73.5	88.5
10	153.0	227.5	217.5	*2,079.4*	96.0	36.5	124.5	96.5	28.0	73.5	72.0	97.0
11	151.0	188.5	177.5	467.5	88.5	39.0	100.0	96.5	25.7	68.0	86.0	369.3
12	362.0	154.0	163.0	316.0	76.5	34.0	80.0	100.5	22.5	66.0	138.8	303.5
13	448.0	396.3	154.0	245.0	68.0	26.0	76.5	84.0	*596.4*	54.5	106.5	187.5
14	318.7	678.4	123.0	209.5	61.0	25.5	69.0	72.0	101.0	41.5	*71.0*	72.0
15	362.0	*1,092.5*	123.0	2,064.7	52.0	*24.3*	63.0	63.0	57.5	38.0	71.0	72.0
16	648.0	188.0	305.5	777.5	47.5	760.6	59.0	57.0	31.0	38.0	108.0	88.5
17	424.2	115.0	116.0	319.5	51.5	1,111.5	390 5	50.5	22.5	34.5	146.0	679.6
18	256.5	125.0	144.0	250.5	44.0	2,256.6	166.0	47.0	109.5	31.0	400.5	483.0
19	242.0	115.0	142.0	218.5	33.5	*2,756.5*	73.0	*45.0*	104.5	31.0	*619.7*	200.5
20	200.5	124.5	164.0	195.0	32.0	524.5	56.0	43.0	34.5	42.5	253.5	538.0
21	138.0	369.7	197.5	171.5	*28.5*	235.5	155.5	47.0	121.0	139.7	190.5	792.0
22	*88.0*	983.4	175.5	152.0	28.5	303.2	153.5	210.0	45.5	955.3	173.5	549.8
23	138.0	264.5	134.5	143.0	31.0	605.2	61.0	79.5	60.0	550.5	147.5	288.5
24	241.3	180.0	*115.0*	133.5	31.0	895.0	66.0	125.0	60.5	219.0	122.0	144.0
25	183.5	342.5	115.0	125.0	31.0	247.5	54.0	444.7	34.0	163.0	149.0	144.0
26	143.5	635.3	214.0	115.0	31.0	172.0	45.5	168.0	29.0	209.5	141.5	144.0
27	129.0	198.0	2,160.7	100.5	42.5	144.5	43.0	131.5	28.0	196.0	94.0	178.5
28	305.5	144.5	1,226.5	92.0	574.5	123.0	*41.0*	125.5	25.0	126.0	84.5	213.0
29	290.5	.....	739.8	83.5	*1,064.0*	106.5	148.0	96.5	22.0	111.0	78.0	213.0
30	159.5	.....	362.5	*83.5*	209.0	97.0	408.0	85.0	*18.5*	96.5	73.5	178.5
31	142.0	.....	552.0	.....	102.5	.....	116.5	74.0	.....	87.5	.....	*1,755.2*

NOTE.—Italic figures indicate maximum and minimum.

Monthly discharge of Neshaminy Creek, at forks, Pennsylvania, for 1906.

[Drainage area, 139 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	1,540	88.0	281	2.02	2.33
February	1,090	80.0	270	1.94	2.02
March	3,050	115.0	484	3.48	4.01
April	2,080	83.5	359	2.58	2.88
May	1,060	28.5	127	.914	1.05
June	2,740	24.3	366	2.63	2.93
July	2,790	41.0	252	1.81	2.09
August	1,500	43.0	164	1.18	1.36
September	596	18.5	651	4.68	5.22
October	2,410	18.5	206	1.48	1.71
November	620	71.0	160	1.15	1.28
December	1,760	62.0	273	1.96	2.26
The year	3,050	18.5	299	2.15	29.14

SCHUYLKILL RIVER NEAR PHILADELPHIA, PA.

Records of the height of the Schuylkill at Fairmount pool have been kept for many years, but not in such form as to be useful in computing daily discharges. In 1898, however, careful estimates were prepared by John E. Codman, in charge of hydrographic work, bureau of water, city of Philadelphia.

The figures for daily discharge in the following table represent the total flow of the stream, computed from the amount wasted over the flashboards at the Fairmount dam, the pumpage from the river, the leakage, and also the quantity used for power at Fairmount. They were furnished by John E. Codman. The conditions at the station are described in Water-Supply Paper No. 166, page 92, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Schuylkill River at Fairmount dam, near Philadelphia, Pa., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,143	2,106	2,549	5,445	1,548	1,394	1,216	1,204	727	1,257	1,347	1,422
2	1,887	1,955	2,440	4,328	1,580	1,352	1,166	1,204	727	1,257	1,347	1,422
3	*1,693*	1,715	5,991	3,758	1,580	1,352	1,256	2,281	727	1,257	1,347	1,422
4	*7,811*	1,627	*27,025*	3,229	1,580	1,260	*5,489*	*10,084*	727	1,257	1,347	1,422
5	6,601	1,719	16,857	2,957	1,580	1,260	2,152	4,172	727	*4,259*	1,347	1,422
6	4,096	1,627	8,952	2,828	1,580	1,260	1,337	1,507	727	2,382	1,347	1,422
7	3,515	1,627	5,621	2,739	1,420	1,260	1,166	*1,204*	727	*1,257*	1,347	1,422
8	3,043	1,627	4,753	2,566	1,420	1,260	1,166	1,204	727	1,257	1,347	1,422
9	2,642	1,627	4,186	2,853	1,420	1,260	1,105	1,204	727	1,257	1,347	1,422
10	2,180	1,803	3,590	*16,205*	1,324	1,260	*1,072*	1,204	727	1,257	1,347	1,422
11	1,942	1,803	3,220	7,836	1,324	1,260	1,072	1,204	727	1,257	1,347	1,422
12	2,325	*1,627*	2,835	6,271	1,324	1,260	1,072	1,204	727	1,257	1,347	1,422
13	2,868	1,811	2,704	4,590	1,324	1,260	1.072	1,204	*1,206*	1,257	1,347	1,422
14	2,787	2,710	2,544	3,729	1,324	1,260	1,072	1,204	987	1,257	1,347	1,422
15	2,627	3,604	2,544	10,170	1,324	*1,260*	1,072	1,204	755	1,257	1,347	1,422
16	3,569	2,501	2,544	15,734	1,324	1,778	1,096	1,204	727	1,257	1,347	1,422
17	4,000	1,813	2,477	15,224	1,324	2,427	1,181	1,204	727	1,257	*1,347*	2,150
18	3,139	1,719	2,177	6,055	1,324	3,034	1,181	1,204	727	1,257	1,439	3,117
19	2,563	1,627	2,177	4,294	1,324	*19,978*	1,072	1,204	727	1,257	*2,505*	1,662
20	2,272	1,761	2,137	3,423	1,324	7,525	1,072	1,204	727	1,257	1,607	1,422

Daily discharge, in second-feet, of Schuylkill River at Fairmount dam, near Philadelphia, Pa., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	2,207	3,167	2,097	2,925	1,324	4,279	1,072	1,296	727	3,165	1,354	2,864
22	2,207	*16,053*	2,097	2,740	1,324	4,279	1,095	1,296	727	2,531	1,347	2,944
23	2,207	10,279	1,957	2,536	1,324	4,885	1,072	1,296	727	1,349	1,347	2,711
24	4,121	5,470	*1,873*	2,399	1,324	4,679	1,072	1,204	727	1,282	1,347	2,631
25	3,044	4,558	1,873	2,286	1,324	3,069	1,072	1,204	727	1,349	1,347	3,333
26	2,707	6,325	2,097	1,994	1,324	2,011	1,072	1,204	727	1,713	1,347	*1,422*
27	2,482	4,369	4,349	1,906	*1,324*	1,754	1,072	1,209	727	1,257	1,347	1,422
28	2,818	3,225	9,793	1,838	6,394	1,617	1,072	1,296	727	1,257	1,347	1,422
29	3,085	.....	7,031	1,766	*13,566*	1,462	1,551	1,204	727	1,257	1,347	1,422
30	2,614	.....	6,081	*1,722*	2,931	1,445	1,382	1,204	727	1,257	1,347	1,422
31	2,209	.....	5,946	.....	1,805	.....	1,072	1,204	.....	1,257	.....	*5,786*

NOTE.—Italic figures indicate maximum and minimum.

Monthly discharge of Schuylkill River at Fairmount dam, near Philadelphia, Pa., for 1906.

[Drainage area, 1,920 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	7,810	1,690	3,010	1.57	1.81
February	16,100	1,630	3,280	1.71	1.78
March	27,000	1,870	4,920	2.56	2.95
April	16,200	1,720	4,880	2.54	2.83
May	13,600	1,320	2,010	1.05	1.21
June	20,000	1,260	2,780	1.45	1.62
July	5,490	1,070	1,310	.682	.79
August	10,100	1,200	1,640	.854	.98
September	1,210	727	753	.392	.44
October	4,260	1,260	1,510	.786	.91
November	2,500	1,350	1,400	.729	.81
December	5,790	1,420	1,890	.984	1.13
The year	27,000	727	2,450	1.28	17.26

PERKIOMEN CREEK AT FREDERICK, PA.

Measurements of this creek were begun on August 20, 1884. The station is located at Frederick, about 12 miles above the mouth, and also above two large tributaries known as West Swamp Creek and Northeast Branch of Perkiomen. Both of these tributaries have been measured, the first at Zieglerville and the second at Schwenkville. The records of daily discharge for 1906 have been furnished by John E. Codman. The conditions at the station are described in Water-Supply Paper No. 166, page 93, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Perkiomen Creek at Frederick, Pa., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec
1	151.5	168.0	198.0	394.0	119.5	146.0	91.5	62.5	57.2	*33.5*	281.6	44.7
2	*137.5*	189.5	178.0	297.0	113.0	124.0	78.5	55.0	41.4	42.4	163.0	47.0
3	161.0	117.5	2,115.0	238.0	115.0	105.0	91.5	1,339.3	38.3	47.8	113.5	61.1
4	*1,512.0*	108.0	*4,054.4*	207.0	111.5	83.5	*421.5*	*1,690.5*	45.8	51.9	76.5	62.3
5	648.8	92.0	557.5	200.0	102.0	75.0	193.5	241.5	44.3	213.5	61.0	43.2
6	356.0	92.0	382.5	212.0	104.0	75.0	112.2	93.0	42.7	197.5	58.0	106.9
7	180.8	*86.0*	318.5	202.0	116.5	82.5	83.5	101.5	42.7	77.0	58.0	213.0
8	193.0	86.0	311.0	176.0	114.5	89.5	71.0	88.5	42.7	58.0	58.0	111.0
9	178.0	106.0	301.5	1,190.4	113.5	82.0	67.5	106.5	34.5	58.0	58.0	58.0
10	192.0	121.0	262.5	*3,026.6*	117.5	79.5	71.5	106.0	26.3	58.0	46.7	95.0
11	171.0	110.0	223.5	687.3	105.5	76.0	67.5	84.0	*26.3*	50.9	28.7	243.6
12	218.5	104.5	203.0	422.0	96.0	63.0	59.0	71.0	90.2	43.7	75.0	163.0
13	314.2	117.5	178.0	326.5	83.5	51.9	54.9	58.0	*292.0*	42.2	83.5	121.5
14	244.5	170.2	163.0	276.0	75.0	*48.3*	59.5	55.0	91.8	35.8	63.5	88.0
15	257.0	217.5	168.0	2,533.3	75.0	50.7	93.0	48.9	43.7	38.3	63.5	83.5
16	581.0	172.0	188.0	1,109.5	76.5	54.3	55.3	44.7	40.6	45.8	75.0	112.0
17	452.0	144.0	196.0	431.0	71.5	69.0	46.8	40.6	30.9	38.4	79.5	455.0
18	290.0	104.5	140.0	332.5	68.0	775.2	62.5	39.1	30.9	36.3	294.7	472.5
19	252.5	128.5	166.0	286.5	64.0	*2,195.2*	61.4	35.8	45.6	47.3	*778.5*	177.0
20	216.0	224.7	183.0	202.0	58.0	441.5	51.3	*28.6*	40.9	153.4	263.0	312.0
21	154.5	1,498.1	178.0	227.5	54.9	232.0	51.9	63.6	26.3	240.5	200.5	743.2
22	168.5	*2,165.3*	157.5	203.5	54.3	301.5	51.9	88.0	30.9	202.0	221.2	537.0
23	249.0	480.7	129.0	195.0	51.3	247.0	43.3	60.4	33.0	148.0	184.2	315.5
24	688.8	328.0	133.5	190.0	45.8	248.0	83.2	83.2	28.6	121.5	128.2	185.0
25	312.0	592.3	*118.5*	170.0	50.0	177.5	83.2	49.3	42.1	*509.0*	88.0	152.5
26	214.0	599.8	153.5	157.0	*44.9*	124.0	46.3	46.7	70.9	352.5	75.0	108.5
27	188.0	258.0	1,379.2	143.0	51.2	106.0	46.8	77.7	34.0	191.5	75.0	99.0
28	492.7	182.0	1,999.8	129.0	*1,864.6*	99.0	*33.6*	170.7	26.3	132.5	75.0	88.0
29	286.0	.....	1,206.0	*117.5*	1,543.3	85.5	63.8	111.0	26.3	119.5	60.4	92.0
30	190.0	.....	530.5	119.5	299.3	92.5	101.5	71.0	26.3	106.0	44.7	130.0
31	168.0	.....	745.5	.....	183.0	.....	93.0	62.5	.....	109.5	.....	*3,362.6*

NOTE.—Italic figures indicate maximum and minimum.

Monthly discharge of Perkiomen Creek at Frederick, Pa., for 1906.

[Drainage area 152 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	1,510	138	317	2.09	2.41
February	2,170	86.0	311	2.05	2.14
March	4,050	118	555	3.65	4.21
April	3,030	118	480	3.16	3.53
May	1,860	44.9	198	1.30	1.50
June	2,200	48.3	216	1.42	1.58
July	422	38.6	83.8	.551	.64
August	1,690	28.6	170	1.12	1.29
September	292	26.3	49.8	.328	.37
October	509	33.5	116	.763	.88
November	778	28.7	131	.862	.96
December	3,360	44.7	287	1.89	2.18
The year	4,050	26.3	243	1.60	21.69

WISSAHICKON CREEK NEAR PHILADELPHIA, PA.

Wissahickon Creek is the principal stream draining into Schuylkill River from the north below Perkiomen Creek. The records of daily discharge for 1906, as furnished by John E. Codman, are given in the following table:

Daily discharge, in second-feet, of Wissahickon Creek near Philadelphia, Pa., for 1906.

[Drainage area, 64.6 square miles.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	63.8	41.8	41.8	157.5	68.3	54.7	46.8
2	54.2	33.7	*32.3*	173.0	61.5	16.8	18.7
3	92.3	26.1	1,010.5	102.0	56.2	9.3	19.3
4	*437.5*	22.3	*1,121.9*	95.9	52.3	7.3	*887.9*
5	215.3	22.3	205.7	102.0	48.6	7.0	219.4
6	131.7	21.7	91.7	98.7	48.6	10.0	72.9
7	111.2	*21.7*	142.0	91.2	47.3	13.2	72.9
8	105.4	34.8	141.5	91.3	44.6	13.5	63.5
9	82.1	69.3	131.5	*628.7*	44.6	16.9	47.4
10	68.4	93.6	121.3	598.0	44.6	17.4	47.4
11	63.8	95.9	114.6	197.5	41.9	10.2	47.4
12	101.9	95.9	104.4	166.2	37.8	7.0	23.8
13	128.2	187.8	95.3	140.3	35.0	7.7	16.0
14	152.4	386.8	93.6	114.6	32.3	6.3	15.4
15	161.3	417.7	93.6	475.6	29.6	*3.1*	15.8
16	137.0	128.3	91.3	205.0	28.2	229.2	19.2
17	128.1	89.5	79.8	140.0	28.2	236.5	205.5
18	111.2	72.9	77.5	131.5	22.2	848.1	191.9
19	102.7	57.4	86.7	123.1	*21.6*	*1,096.5*	42.5
20	97.6	52.8	104.9	118.0	22.2	213.7	18.9
21	101.0	101.9	114.5	112.9	22.8	148.7	69.9
22	106.1	289.0	102.6	109.5	22.8	158.0	115.4
23	89.5	89.5	95.3	111.0	22.8	219.0	58.8
24	68.4	89.5	89.0	95.9	22.8	323.7	23.2
25	63.8	140.5	99.8	91.3	22.8	140.3	12.7
26	52.8	221.9	136.3	84.4	22.8	104.8	*11.7*
27	*39.1*	88.4	499.6	79.8	64.4	70.2	56.1
28	105.7	56.9	334.7	77.5	*148.9*	59.2	47.6
29	143.9	.....	156.5	75.2	148.9	54.6	57.3
30	81.1	.....	129.7	*72.9*	22.8	63.7	106.1
31	47.3	.....	185.1	.....	54.7	.....	85.0

NOTE.—Dam drained out and observations discontinued after July. Italic figures indicate maximum and minimum.

Monthly discharge of Wissahickon Creek near Philadelphia, Pa., for 1906.

[Drainage area, 64.6 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	438	39.1	111	1.72	1.98
February	418	21.7	109	1.69	1.76
March	1,120	32.3	94.4	1.46	1.68
April	629	72.9	162	2.51	2.80
May	149	21.6	44.9	.695	.80
June	1,100	3.1	139	2.15	2.40
July	888	11.7	88.1	1.36	1.57

INDEX.

A. Page.

Acknowledgments and cooperation 16
Acre-foot, definition of 4

B.

Barrows, H. K., work of 1
Bloomsbury, N. J.
Musconetong River near:
description 64
discharge 65
discharge, monthly 66
gage heights 65
rating table 66
Bolster, R. H., work of 1
Boundbrook, N. J.
Raritan River at:
description 57
discharge 57
discharge, monthly 58
gage heights 57–58
rating table 58
Buskirk, N. Y.
Hoosic River at:
description 21
discharge 21
discharge, monthly 23
gage heights 22
rating table 22

C.

Cable station, figure showing 10
Catskill Creek at—
South Cairo, N. Y.:
description 36
discharge 36
gage heights 36
Chatham, N. J.
Passaic River near:
description 48
discharge 48
discharge, monthly 49
gage heights 48
rating table 49
Coleman, N. Y.
Oriskany Creek at:
description 25
discharge 25
gage heights 25
Computation, methods of 13–16
Cooperation and acknowledgments 16
Corinth, N. Y. Page.
Hudson River at:
discharge 44
Covert, C. C., work of 1
Creeklocks, N. Y.
Delaware and Hudson Canal at:
description 41
discharge, daily 42
discharge, monthly 42
Current meters, classes of 10
methods of using 10–11
plate showing 10
Current-meter station, view of 10
Curves (area, discharge, and velocity) figure showing 15

D.

Definitions of terms used 3–4
Delaware and Hudson Canal at—
Creeklocks, N. Y.:
description 41
discharge, daily 42
discharge, monthly 42
Delaware River at—
Riegelsville, N. J.:
description 63
discharge 63
gage heights 63
Lambertville, N. J.:
description 64
discharge 64
gage heights 64
Delaware River (East Branch) at—
Hancock, N. Y.:
description 61
discharge 62
discharge, monthly 63
gage heights 62
rating table 62
Delaware River (West Branch) at—
Hancock, N. Y.:
description 60
discharge 60
discharge, monthly 61
gage heights 60
rating table 61
Delaware River basin:
description 59
Discharge, measurement and computation of 13–16

Page.
Dolgeville, N. Y.
East Canada Creek at—
description 31
discharge, daily 32
discharge, monthly 32
Drainage basins, list of 2–3
map showing 1
Dunsbach Ferry Bridge, N. Y.
Mohawk River at:
description 24
discharge, daily 24
discharge, monthly 25

E.

East Branch Delaware River. *See* Delaware River (East Branch).
East Canada Creek at—
Dolgeville, N. Y.:
description 31
discharge, daily 32
discharge, monthly 32
Equivalents, table of 6–7
Esopus Creek at and near—
Kingston, N. Y.:
description 36–37
discharge 37
discharge, monthly 38
gage heights 37
rating tables 38
Olivebridge, N. Y.:
description 38–39
discharge, daily 39
discharge, monthly 40

F.

Finderne, N. J.
Raritan River at:
description 56
discharge 56
discharge, monthly 57
gage heights 56
rating table 57
Floats, use of, in measuring discharge 9–10
Follansbee, Robert, work of 1
Fort Edward, N. Y.
Hudson River at:
description 19
discharge, daily 19
discharge, monthly 19
Fox Creek near—
Schoharie Creek:
discharge 44
Frederick, Pa.
Perkiomen Creek at:
description 69
discharge, daily 70
discharge, monthly 70

G.

Gaging stations, equipment of 9–10
location of, map showing 2
Graefenberg Creek near—
New Hartford, N. Y.:
description 28
Graefenberg Creek near—Cont'd.
New Hartford, N. Y.—Cont'd.
discharge, daily 28
discharge, monthly 28
Grover, N. C., work of 1

H.

Hancock, N. Y.
Delaware River (East Branch) at:
description 61
discharge 62
discharge, monthly 63
gage heights 62
rating table 63
Delaware River (West Branch) at:
description 60
discharge 60
discharge, monthly 61
gage heights 60
rating table 61
Henshaw, F. F., work of 1
Hoosic River at—
Buskirk, N. Y.
description 21
discharge 21
discharge, monthly 23
gage heights 22
rating table 22
Horsepower, calculation of 5
Horton, R. E., work of 1
Hoyt, J. C., work of 1
Hudson River at—
Corinth, N. Y.:
discharge 44
Fort Edward, N. Y.:
description 19
discharge, daily 19
discharge, monthly 19
Mechanicsville, N. Y.:
description 20
discharge, daily 20
discharge, monthly 20
Hudson River basin:
description 16–18
miscellaneous measurements 44

I.

Ice-covered streams, measurement of 13
Indian Lake, N. Y.
Indian Lake reservoir at:
description 21
gage heights 21
Indian Lake reservoir at—
Indian Lake, N. Y.:
description 21
gage heights 21

K.

Kast Bridge, N. Y.
West Canada Creek at:
description 30
discharge 30
gage heights 31

Kinderhook Creek at— Page.
Rossman, N. Y.:
description 34–35
discharge 35
gage heights 35
Kingston, N. Y.
Esopus Creek at:
description 36–37
discharge 37
discharge, monthly 38
gage heights 37
rating table 38

L.

Lambertville, N. J.
Delaware River at:
description 64
discharge 64
gage heights 64
Little Falls, N. Y.
Mohawk River at:
description 23
discharge, daily 23
discharge, monthly 24

M.

Mahwah, N. J.
Ramapo River near:
description 49
discharge, monthly 51
gage heights 50
rating table 50
Mechanicsville, N. Y.
Hudson River at:
description 20
discharge, daily 20
discharge, monthly 20
Middleville, N. Y.
Schoharie Creek at:
discharge 44
Millington, N. J.
Passaic River at:
description 45
discharge 45
discharge, monthly 47
gage heights 46
horsepower 48
rating table 46
Miner's inch, definition of 4
Mohawk River at—
Dunsbach Ferry Bridge, N. Y.:
description 24
discharge, daily 24
discharge, monthly 25
Little Falls, N. Y.:
description 23
discharge, daily 23
discharge, monthly 24
Multiple-point method of measuring discharge, description of 11–12
Musconetcong River near—
Bloomsbury, N. J.:
description 64
discharge 65

Musconetcong River near—Cont'd. Page.
Bloomsbury, N. J.—Continued.
discharge, monthly 66
gage heights 65
rating table 65

N.

Neshaminy Creek at—
its forks, Pa.:
description 67
discharge, daily 67
discharge, monthly 68
New Hartford, N. Y.
Graefenberg Creek near:
description 28
discharge, daily 28
discharge, monthly 28
Starch Factory Creek near:
description 26
discharge, daily 26
discharge, monthly 26
Sylvan Glen Creek near:
description 27
discharge, daily 27
discharge, monthly 27
North Branch Raritan River. *See* Raritan River (North Branch).
Northville, N. Y.
Sacandaga River at:
discharge 44

O.

Olivebridge, N. Y.
Esopus Creek near:
description 38–39
discharge, daily 39
discharge, monthly 40
Oriskany Creek at and near—
Coleman, N. Y.:
description 25
discharge 25
gage heights 25
Walesville, N. Y.:
discharge 44

P.

Padgett, H. D., work of 1
Passaic River at and near—
Chatham, N. J.:
description 48
discharge 48
discharge, monthly 49
gage heights 48
rating table 49
Millington, N. J.:
description 45
discharge 45
discharge, monthly 47
gage heights 46
horsepower 48
rating table 46
Passaic River basin:
description 45

Page.
Perkiomen Creek at—
Frederick, Pa.:
description 69
discharge, daily 70
discharge, monthly 70
Philadelphia, Pa.
Schuylkill River near:
description 68
discharge, daily 68–69
discharge, monthly 69
Wissahickon Creek near:
description 70
discharge, daily 71
discharge, monthly 71
Pluckemin, N. J.
Raritan River (North Branch) near:
description 53
discharge 53
discharge, monthly 55
gage heights 54
horsepower 55–56
rating table 54
Point Pleasant, Pa.
Tohickon Creek at:
description 66
discharge, daily 66
discharge, monthly 67
Prattsville, N. Y.
Schoharie Creek at:
description 32
discharge 33
discharge, monthly 34
gage heights 33
rating table 34
Price current meter, view of 10

R.

Ramapo River near—
Mahwah, N. J.:
description 49
discharge, monthly 51
gage heights 50
rating table 50
Raritan River at—
Boundbrook, N. J.:
description 57
discharge 57
discharge, monthly 58
gage heights 57–58
rating table 58
Finderne, N. J.:
description 56
discharge 56
discharge, monthly 57
gage heights 56
rating table 57
Raritan River (North Branch) near—
Pluckemin, N. J.:
description 53
discharge 53
discharge, monthly 55
gage heights 54
horsepower 55–56
rating table 54

Page.
Raritan River (South Branch) at—
Stanton, N. J.:
description 52
discharge 52
discharge, monthly 53
gage heights 52
rating table 52
Raritan River basin:
description 51
Rating curves, construction of 14
Rating tables, construction of 13–15
Riegelsville, N. J.
Delaware River at:
description 63
discharge 63
gage heights 63
Rondout Creek at—
Rosendale, N. Y.:
description 42
discharge 43
discharge, monthly 44
gage heights 44
rating tables 44
Rosendale, N. Y.
Rondout Creek at:
description 42
discharge 43
discharge, monthly 44
gage heights 44
rating tables 44
Rossman, N. Y.
Kinderhook Creek at:
description 34–35
discharge 35
gage heights 35
Run-off, computation of 13–16
Run-off in inches, definition of 4

S.

Sacondaga River at—
Northville, N. Y.:
discharge 44
Schoharie Creek at or near—
Middleville, N. Y.:
discharge 44
Prattsville, N. Y.:
description 32
discharge 33
discharge, monthly 34
gage heights 33
rating table 34
Schoharie Junction:
discharge 44
Schoharie Junction, N. Y.
Schoharie Creek near:
discharge 44
Schuylkill River near—
Philadelphia, Pa.:
description 68
discharge, daily 68–69
discharge, monthly 69
Second-feet per square mile, definition of 4
Second-foot, definition of 4

Page.

Single-point method of measuring discharge, description of 12
Slope method of measuring discharge, use and value of 7–8
South Branch Raritan River. *See* Raritan River (South Branch).
South Cairo, N. Y.
Catskill Creek at:
description 36
discharge 36
gage heights 36
Stanton, N. J.
Raritan River (South Branch) at:
description 52
discharge 52
discharge, monthly 53
gage heights 52
rating table 52
Starch Factory Creek near—
New Hartford, N. Y.:
description 26
discharge, daily 26
discharge, monthly 26
Stream flow, measurement and computation of 7–13
papers on, list of 3
Surface water supply, papers on 2–3
Sylvan Glen Creek near—
New Hartford, N. Y.:
description 27
discharge, daily 27
discharge, monthly 27

T.

Tables, explanation of 4–6
Tohickon Creek at—
Point Pleasant, Pa.:
description 66
discharge, daily 66
discharge, monthly 67
Twin Rock Bridge, N. Y.
West Canada Creek at:
description 29
discharge 29
discharge, monthly 30
gage heights 29
rating table 30

V.

Page.

Velocity method of measuring discharge, description of 9–13
Vertical integration method of measuring discharge, description of 12
Vertical velocity-curve method of measuring discharge, description of 11–12

W.

Walesville, N. Y.
Oriskany Creek at:
discharge 44
Wappinger Creek near—
Wappinger Falls, N. Y.:
description 40
discharge, monthly 41
rating tables 40
Wappinger Falls, N. Y.
Wappinger Creek near:
description 40
discharge, monthly 41
rating tables 40
Waterpower, calculation of 5
Water supply, surface, papers on 2–3
Weir method of measuring discharge, requirements of 8–9
West Branch Delaware River. *See* Delaware River (West Branch).
West Canada Creek at—
Kast Bridge, N. Y.:
description 30
discharge 30
gage heights 31
Twin Rock Bridge, N. Y.:
description 29
discharge 29
discharge, monthly 30
gage heights 29
rating table 30
Wissahickon Creek near—
Philadelphia, Pa.:
description 70
discharge, daily 71
discharge, monthly 71

CLASSIFICATION OF THE PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

[Water-Supply Paper No. 202.]

The publications of the United States Geological Survey consist of (1) Annual Reports; (2) Monographs; (3) Professional Papers; (4) Bulletins; (5) Mineral Resources; (6) Water-Supply and Irrigation Papers; (7) Topographic Atlas of United States, folios and separate sheets thereof; (8) Geologic Atlas of United States, folios thereof. The classes numbered 2, 7, and 8 are sold at cost of publication; the others are distributed free. A circular giving complete lists can be had on application.

Most of the above publications can be obtained or consulted in the following ways:

1. A limited number are delivered to the Director of the Survey, from whom they can be obtained, free of charge (except classes 2, 7, and 8), on application.
2. A certain number are delivered to Senators and Representatives in Congress, for distribution.
3. Other copies are deposited with the Superintendent of Documents, Washington, D. C., from whom they can be had at practically cost.
4. Copies of all Government publications are furnished to the principal public libraries in the large cities throughout the United States, where they can be consulted by those interested.

The Professional Papers, Bulletins, and Water-Supply Papers treat of a variety of subjects, and the total number issued is large. They have therefore been classified into the following series: A, Economic geology; B, Descriptive geology; C, Systematic geology and paleontology; D, Petrography and mineralogy; E, Chemistry and physics; F, Geography; G, Miscellaneous; H, Forestry; I, Irrigation; J, Water storage; K, Pumping water; L, Quality of water; M, General hydrographic investigations; N, Water power; O, Underground waters; P, Hydrographic progress reports; Q, Fuels; R, Structural materials.

Series P.—The hydrographic progress reports contain the results of stream measurements. A report is issued for every calendar year, containing the results of data collected during that year. These reports were first published as a part of the Director's annual report or as a bulletin; they are now published as water-supply and irrigation papers. The following is a list, by years, of the publications containing the progress reports of stream measurements (* means out of stock). A detailed index of these reports (1888–1903) is published as Water-Supply Paper No. 119.

1888. Tenth Annual Report, Part II*.
1889. Eleventh Annual Report, Part II*.
1890. Twelfth Annual Report, Part II*.
1891. Thirteenth Annual Report, Part III*.
1892. Fourteenth Annual Report, Part II*.
1893. Bulletin No. 131*.
1894. Bulletin No. 131*; Sixteenth Annual Report, Part II*.
1895. Bulletin No. 140*.
1896. Water-Supply Paper No. 11*; Eighteenth Annual Report, Part IV*.
1897. Water-Supply Papers Nos. 15* and 16*; Nineteenth Annual Report, Part IV*.
1898. Water-Supply Papers Nos. 27* and 28*; Twentieth Annual Report, Part IV*.
1899. Water-Supply Papers Nos. 35*, 36*, 37*, 38*, and 39*; Twenty-first Annual Report, Part IV*.
1900. Water-Supply Papers Nos. 47, 48, 49, 50, 51, and 52; Twenty-second Annual Report, Part IV.
1901. East of Mississippi River, Water-Supply Papers Nos. 65* and 75*.
West of Mississippi River, Water-Supply Papers Nos. 66 and 75*.

1902. East of Mississippi River, Water-Supply Papers Nos. 82 and 83.
West of Mississippi River, Water-Supply Papers Nos. 84 and 85.
1903. East of Mississippi River, Water-Supply Papers Nos. 97 and 98.
West of Mississippi River, Water-Supply Papers Nos. 99 and 100.
1904. East of Mississippi River, Water-Supply Papers Nos. 124, 125, 126, 127, 128, and 129.
West of Mississippi River, Water-Supply Papers Nos. 130, 131, 132, 133, 134, and 135.
1905. East of Mississippi River, Water-Supply Papers Nos. 165*, 166* 167, 168*, 169, 170, and 171.
West of Mississippi River, Water-Supply Papers Nos. 171, 172*, 173*, 174, 175*, 176, 177, and 178.
1906. East of Mississippi River, Water-Supply Papers Nos. 201, 202, 203, 204, 205, 206, and 207.
West of Mississippi River, Water-Supply Papers Nos. 207, 208, 209, 210, 211, 212, 213, and 214.

Correspondence should be addressed to

THE DIRECTOR,
UNITED STATES GEOLOGICAL SURVEY,
WASHINGTON, D. C.

SEPTEMBER, 1907.

O

Water-Supply and Irrigation Paper No. 203 Series P, Hydrographic Progress Reports, 57

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

SURFACE WATER SUPPLY
OF
MIDDLE ATLANTIC STATES, 1906

(SUSQUEHANNA, GUNPOWDER, PATAPSCO, POTOMAC, JAMES, ROANOKE, AND YADKIN RIVER DRAINAGES)

N. C. GROVER
DISTRICT HYDROGRAPHER

WASHINGTON
GOVERNMENT PRINTING OFFICE
1907

CONTENTS.

	Page.
Introduction	1
Scope of work	1
Definitions	3
Explanation and use of tables	4
Convenient equivalents	6
Field methods of measuring stream flow	7
Office methods of computing run-off	13
Cooperation and acknowledgments	16
Middle Atlantic States drainages	16
Susquehanna River drainage basin	16
Description of basin	16
Susquehanna River at Binghamton, N. Y	17
Susquehanna River at Wilkesbarre, Pa	19
Susquehanna River at Danville, Pa	21
Susquehanna River at Harrisburg, Pa	23
Susquehanna River near McCall Ferry, Pa	26
Chenango River at Binghamton, N. Y	27
Chemung River at Chemung, N. Y	29
West Branch of Susquehanna River at Williamsport, Pa	31
Juniata River at Newport, Pa	34
Broad Creek at Mill Green, Md	36
Deer Creek near Churchville, Md	37
Gunpowder River drainage basin	39
Description of basin	39
Gunpowder Falls at Glencoe, Md	40
Little Gunpowder Falls near Belair, Md	42
Patapsco River drainage basin	44
Description of basin	44
Patapsco River at Woodstock, Md	45
Potomac River drainage basin	46
Description of basin	47
North Branch of Potomac River at Piedmont, W. Va	48
Potomac River at Point of Rocks, Md	49
South Branch of Potomac River near Springfield, W. Va	51
Savage River at Bloomington, Md	53
Georges Creek at Westernport, Md	55
Wills Creek at Cumberland, Md	57
Opequon Creek near Martinsburg, W. Va	58
Shenandoah River at Millville, W. Va	60
South Fork of Shenandoah River near Front Royal, Va	62
South River at Basic City, Va	63
Lewis Creek near Staunton, Va	65
Cooks Creek at Mount Crawford, Va	67

Middle Atlantic States drainages—Continued.
Potomac River drainage basin—Continued. Page.
Elk Run at Elkton, Va. 68
Hawksbill Creek near Luray, Va. 70
North Fork of Shenandoah River near Riverton, Va. 72
Passage Creek at Buckton, Va. 73
Monocacy River near Frederick, Md. 74
James River drainage basin 76
Description of basin 76
James River at Buchanan, Va. 78
James River at Holcomb Rock, Va. 80
James River at Cartersville, Va. 80
Roanoke River drainage basin 82
Description of basin 82
Roanoke River at Roanoke, Va. 83
Roanoke River at Randolph, Va. 85
Dan River at Madison, N. C. 86
Dan River at South Boston, Va. 87
Cape Fear River drainage basin 88
Miscellaneous measurement 88
Yadkin or Pedee River drainage basin 89
Description of basin 89
Yadkin River near Salisbury, N. C. 90
Yadkin River at North Wilkesboro, N. C 92
Miscellaneous measurements 94
Index 95

ILLUSTRATIONS.

PLATE I. Map of the United States showing locations of principal river stations maintained during 1906 2
II. *A*, Current-meter rating station at Los Angeles, Cal.; *B*, Price current meters 10
III. Power-plant construction: *A*, on Susquehanna River, near McCall Ferry, Pa.; *B*, on Shenandoah River, near Millville, W. Va. 16
IV. Great Falls of Potomac River 48
FIG. 1. Cable station, showing section of river, car, gage, etc 11
2. Discharge, area, and mean-velocity curves for Potomac River at Point of Rocks, Md 14

SURFACE WATER SUPPLY OF THE MIDDLE ATLANTIC STATES, 1906.[a]

N. C. GROVER,

District hydrographer.[b]

INTRODUCTION.

SCOPE OF WORK.

The water supply of the United States is of more importance to the life and pursuits of the people than any other natural resource. In the arid States the limit of agricultural development is determined by the amount of water available for irrigation, while in all parts of the country the increase in the population of cities and towns makes necessary additional water supplies for domestic and industrial uses, in procuring which both the quantity and the quality of the water that may be obtained must be considered. The location of manufacturing plants may depend largely on the water-power facilities and on the character of the water. The notable advances made in the electric transmission of power have led to the utilization of water powers for the operation of manufacturing establishments, railroads, and municipal lighting plants, many of which are at some distance from the places at which the power is developed.

The intelligent establishment and maintenance of enterprises or industries that depend on the use of water demands a thorough knowledge of the flow of the streams and an understanding of the conditions affecting that flow. This knowledge should be based on data showing both the total flow and the distribution of the flow throughout the year, in order that normal fluctuations may be provided for. As the flow of a stream is variable from year to year, estimates of future flow can be made only from a study of observations covering several years. The rapid increase in the development of the water

[a] This report contains information similar to that published for previous years under the title "Report of Progress of Stream Measurements."

[b] The data presented in this report have been collected by local hydrographers, mostly under the direction of N. C. Grover. They have been prepared for publication under the direction of John C. Hoyt, and assistance has been given both in the field and in the office by R. H. Bolster, Robert Follansbee, F. F. Henshaw, H. D. Padgett, and J. E. Stewart.

resources of the United States has caused a great demand by e
for information in regard to the flow of streams, as it is now g
realized that the failure of many large power, irrigation, an
projects has been due to the fact that the plans were made
sufficient trustworthy information in respect to the water su

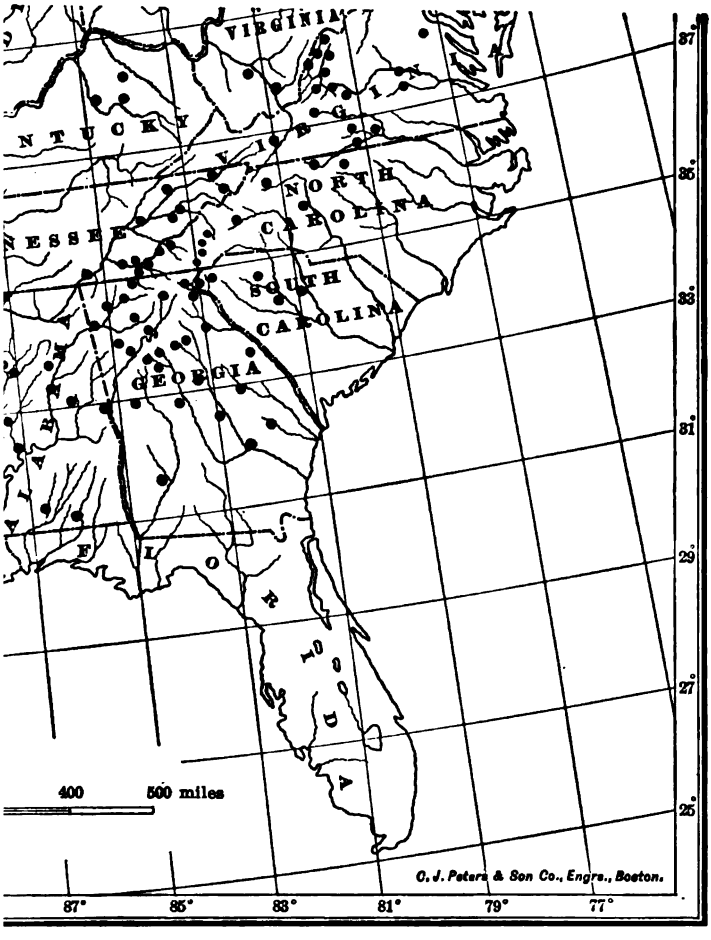
Owing to the broad scope of these hydrographic investigati
the length of time they should cover in order that the records
of greatest value, it is in general impossible for private indivi
collect the necessary data, and as many of the streams traver
than one State this work does not properly fall within the pro
the State authorities. The United States Geological Surv
therefore, by means of specific appropriations by Congress, for
years systematically made records of stream flow, with the
ultimately determining all the important features governing t
of the principal streams of the country. In carrying out th
stations are established on the streams and maintained for a
long enough to show their regimen or general behavior. W
record that is sufficient for this purpose has been obtained f
stream, the work on that stream is discontinued. The or
which the streams are measured is determined by the degree o
importance.

During 1906 the regimen of flow was studied at about 700 st
distributed along the various rivers throughout the United Sta
shown on Pl. I. In addition to these records data in regard t
cipitation, evaporation, water power, and river profiles were ob
in many sections of the country.

These data have been assembled by drainage areas and are
lished in a series of fourteen Water-Supply and Irrigation P
Nos. 201 to 214, inclusive, each of which pertains to the surface
resources of a group of adjacent areas. In these papers are emb
not only the data collected in the field, but also the results of co
tations based on these data and other information that has a d
bearing on the subject, such as descriptions of basins and the str
draining them, utility of the water resources, etc. The list follow

Water-Supply and Irrigation Papers on surface water supply, 1906.

201. Surface water supply of New England, 1906. (Atlantic coast of New En
drainage.)
202. Surface water supply of the Hudson, Passaic, Raritan, and Delaware river d
ages, 1906.
203. Surface water supply of the Middle Atlantic States, 1906. (Susquehanna,
powder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainage
204. Surface water supply of the Southern Atlantic and Eastern Gulf States,
(Santee, Savannah, Ogeechee, and Altamaha rivers, and eastern Gulf of Me
drainages.)
205. Surface water supply of the Ohio and lower eastern Mississippi river drain
1906.


VIRGINIA
NORTH
CAROLINA
SOUTH
CAROLINA
GEORGIA
FLORIDA
400
500 miles
37°
35°
33°
31°
29°
27°
25°
87°
85°
83°
81°
79°
77°
C. J. Peters & Son Co., Engrs., Boston.

URING 1906.

206. Surface water supply of the Great Lakes and St. Lawrence River drainages, 1906.
207. Surface water supply of the upper Mississippi River and Hudson Bay drainages, 1906.
208. Surface water supply of the Missouri River drainage, 1906.
209. Surface water supply of the lower western Mississippi River drainage, 1906.
210. Surface water supply of the western Gulf of Mexico and Rio Grande drainages, 1906.
211. Surface water supply of the Colorado River drainage above Yuma, 1906.
212. Surface water supply of the Great Basin drainage, 1906.
213. Surface water supply of California, 1906. (The Great Basin and Pacific Ocean drainages in California and Colorado River drainage below Yuma.)
214. Surface water supply of the North Pacific Coast, 1906.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing such records up to and including 1903 has been published in Water-Supply Paper No. 119. The following table gives, by years and primary drainage basins, the numbers of the papers on surface water supply published from 1901 to 1906:

Numbers of Water-Supply Papers containing results of stream measurements, 1901–1906.[a]

	1901.	1902.	1903.	1904.	1905.	1906.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
Atlantic coast of New England drainage	65, 75	82	97	124	165	201
Hudson, Passaic, Raritan, and Delaware river drainages	65, 75	82	97	125	166	202
Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages	65, 75	82, 83	97, 98	126	167	203
Santee, Savannah, Ogeechee, and Altamaha rivers and eastern Gulf of Mexico drainages	65, 75	83	98	127	168	204
Ohio and lower eastern Mississippi river drainages	65, 75	83	98	128	169	205
Great Lakes and St. Lawrence River drainages	65	83	97	129	170	206
Hudson Bay and upper eastern and western Mississippi River drainages	65, 66, 75	83, 84, 85	98, 99, 100	128, 130	171	207
Missouri River drainage	66, 75	84	99	130, 131	172	208
Meramec, Arkansas, Red, and lower western Mississippi river drainages	66, 75	84	99	131	173	209
Western Gulf of Mexico and Rio Grande drainages	66, 75	84	99	132	174	210
Colorado River drainage, above Yuma	66, 75	85	100	133	175	211
The Great Basin drainage	66, 75	85	100	133	176	212
The Great Basin and Pacific Ocean drainages in California, and Colorado River drainage, below Yuma	66, 75	85	100	134	177	213
North Pacific Coast drainage	66, 75	85	100	135	178	214

[a] Reports containing data for years prior to 1901 are noted in the series list at the end of this paper

DEFINITIONS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet per square mile, and (2) those which represent the actual quantity of water,

as run-off in depth in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the quantity of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the quantity of water that passes through an orifice 1 inch square under a head which varies locally. It has been commonly used by miners and irrigators throughout the West and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

"Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work. There is a convenient relation between the second-foot and the acre-foot: One second-foot flowing for twenty-four hours will deliver 86,400 cubic feet, or approximately 2 acre-feet.

EXPLANATION AND USE OF TABLES.

For each regular gaging station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of monthly and yearly discharges and run-off.
6. Tables showing discharge and horsepower and the number of days during the year when the same are available.

The descriptions of stations give such general information about the locality and equipment as would enable the reader to find and use the station, and they also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, name of the

hydrographer, width and area of cross section, gage height, and discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. At most stations the gage is read in the morning and in the evening.

The discharge measurements and gage heights are the base data from which the other tables are computed. In cases of extensive development it is expected that engineers will use these original data in making their calculations, as the computations made by the Survey are based on the data available at the time they are made and should be reviewed and, if necessary, revised when additional data are available.

The rating table gives the discharge in second-feet corresponding to various stages of the river as given by the gage heights. It is published to enable engineers to determine the daily discharge in case this information is desired.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow for each second during the month. Upon this the computations for the remaining columns, which are defined on page 4, are based.

The values in the table of monthly discharge are intended to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates.

In most work where data in regard to flow are used the regimen of flow is of primary importance. Therefore for the principal stations tables have been prepared showing the horsepower that can be developed at various rates of flow, and the length of time that these rates of flow and the corresponding horsepower are available. These tables have been prepared on a basis of 80 per cent efficiency on the turbines, and the horsepower per foot of fall is given in order that the reader can determine the horsepower for any fall.

In the computations sufficient significant figures have been used so that the percentage of error in the tables will not in general exceed 1 per cent. Therefore, most of the values in the tables are given to only three significant figures. In making the various computations Thatcher's slide rule, Crelle's tables, and computation machines have been generally used.

In order to give engineers an idea of the relative value of the various data notes in regard to accuracy are given as far as possible. This accuracy depends on the general local conditions at the gaging stations and the amount of data collected. Every effort possible is made to so locate the stations that the data collected will give a high degree of accuracy. This is not always possible, but it is considered better to publish rough values with explanatory notes rather than no data.

In the accuracy notes the following terms have been used, indicating the probable accuracy, in per cent, of the mean monthly flow. As these values are mean values, the error in the value for the flow of any individual day may be much larger.

Excellent indicates that the mean monthly flow is probably accurate to within 5 per cent; good, to within 10 per cent; fair, to within 15 per cent; approximate, to within 25 per cent.

CONVENIENT EQUIVALENTS.

Following is a table of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equal 18.7 United States gallons per second.
100 California miner's inches equal 96.0 Colorado miner's inches.
100 California miner's inches for one day equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 104 California miner's inches.
100 Colorado miner's inches for one day equal 5.17 acre-feet.
100 United States gallons per minute equal 0.223 second-feet.
100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.

1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1½ horsepower equal about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel, realizing 80 per cent of theoretical power.

FIELD METHODS OF MEASURING STREAM FLOW.

The methods used in collecting these data and in preparing them for publication are given in detail in Water-Supply Papers No. 94 (Hydrographic Manual, U. S. Geol. Survey) and No. 95 (Accuracy of Stream Measurements). In order that those who use this report may readily become acquainted with the general methods employed, the following brief descriptions are given:

Streams may be divided, with respect to their physical conditions, into three classes: (1) Those with permanent beds; (2) those with beds which change only during extreme low or high water; and (3) those with constantly shifting beds. In determining the daily flow special methods are necessary for each class. The data on which the determinations are based and the methods of collecting them are, however, in general the same.

There are three distinct methods of determining the flow of open-channel streams: (1) By measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir, (3) by measurements of the velocity of the current and of the area of the cross section. The method chosen for any case depends on the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to the coefficients to be used in the Chezy formula, $v = c\sqrt{Rs}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The

results obtained by the slope method are in general only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for n to be used in Kutter's formula. The most common use of this method is in estimating the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions.

Weir method.—When funds are available and the conditions are such that sharp-crested weirs can be erected, these offer the best facilities for determining flow. If dams are suitably situated and constructed, they may be utilized for obtaining reliable measurements of flow. The conditions necessary to insure good results may be divided into two classes: (1) Those relating to the physical characteristics of the dam itself, and (2) those relating to the diversion and use of water around and through the dam.

The physical requirements are as follows: (*a*) Sufficient height of dam, so that backwater will not interfere with free fall over it; (*b*) absence of leaks of appreciable magnitude; (*c*) topography or abutments which confine the flow over the dam at high stages; (*d*) level crests which are kept free from obstructions caused by floating logs or ice; (*e*) crests of a type for which the coefficients to be used in $Q = c\ b\ h^{\frac{3}{2}}$, or some similar standard weir formula, are known (see Water-Supply Papers Nos. 180 and 200[a]); (*f*) either no flashboards or exceptional care in reducing leakage through them and in recording their condition.

Preferably there should be no diversion of water through or around the dam. Generally, however, the dam is built for purposes of power or navigation, and part or all of the water flowing past it is diverted for such uses. This water is measured and added to that passing over the dam. To insure accuracy in such determinations of flow, the amount of water diverted should be reasonably constant. Furthermore, it should be so diverted that it can be measured, either by a weir, a current meter, or a simple system of water wheels which are of standard make, or which have been rated as meters under working conditions and so installed that the gate openings, the heads under which they work, and their angular velocities may be accurately observed.

The combination of physical conditions and uses of the water should be such that the determinations of flow will not involve, for a critical stage of considerable duration, the use of a head on a broad-crested dam of less than 6 inches. Moreover, when all other conditions are good, the cooperation of the owners or operators of the plant is still essential if reliable results are to be obtained.

[a] Water-Supply Paper No. 200 replaces No. 150, the edition of which has been exhausted.

A gaging station at a weir or dam has the general advantage of continuity of record through the period of ice and floods and the disadvantages of uncertainty of coefficient to be used in the weir formula and of complications in the diversion and use of the water.

Velocity method.—The determination of the quantity of water flowing past a certain section of a stream at a given time is termed a discharge measurement. This quantity is the product of two factors—the mean velocity and the area of the cross section. The mean velocity is a function of surface slope, wetted perimeter, roughness of bed, and the channel conditions at, above, and below the gaging section. The area depends on the contour of the bed and the fluctuations of the water surface. The two principal ways of measuring the velocity of a stream are by floats and current meters.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements, in order that the data may have the required degree of accuracy. Their essential requirements are practically the same, whether the velocity is determined by meters or floats. They are located, as far as possible, where the channel is straight both above and below the gaging section; where there are no cross currents, backwater, or boils; where the bed of the stream is reasonably free from large projections of a permanent character, and where the banks are high and subject to overflow only at flood stages. The station must be so far removed from the effects of tributary streams and of dams or other artificial obstructions that the gage height shall be an index of the discharge.

Certain permanent or semipermanent structures, usually referred to as "equipment," are generally pertinent to a gaging station. These are a gage for determining the fluctuations of the water surface, bench marks to which the datum of the gage is referred, permanent marks on a bridge or a tagged line indicating the points of measurement, and, where the current is swift, some appliance (generally a secondary cable) to hold the meter in position in the water. As a rule the stations are located at bridges if the channel conditions are satisfactory, as from them the observations can more readily be made and the cost of the equipment is small.

The floats in common use are the surface, subsurface, and tube or rod floats. A corked bottle with a flag in the top and weighted at the bottom makes one of the most satisfactory surface floats, as it is affected but little by wind. In case of flood measurements good results can be obtained by observing the velocity of floating cakes of ice or débris. In case of all surface-float measurements coefficients must be used to reduce the observed velocity to the mean velocity. The subsurface and tube or rod floats are intended to give directly the mean velocity in the vertical. Tubes give excellent results when the channel conditions are good, as in canals.

In measuring velocity by a float, observation is made of the time taken by the float to pass over the "run," a selected stretch of river from 50 to 200 feet long. In each discharge measurement a large number of velocity determinations are made at different points across the stream, and from these observations the mean velocity for the whole section is determined. This may be done by plotting the mean positions of the floats, as indicated by the distances from the bank, as ordinates and the corresponding times as abscissas. A curve through these points shows the mean time of run at any point across the stream, and the mean time for the whole stream is obtained by dividing the area bounded by this curve and its axis by the width. The length of the run divided by the mean time gives the mean velocity.

The area used in float measurements is the mean of the areas at the two ends of the run and at several intermediate sections.

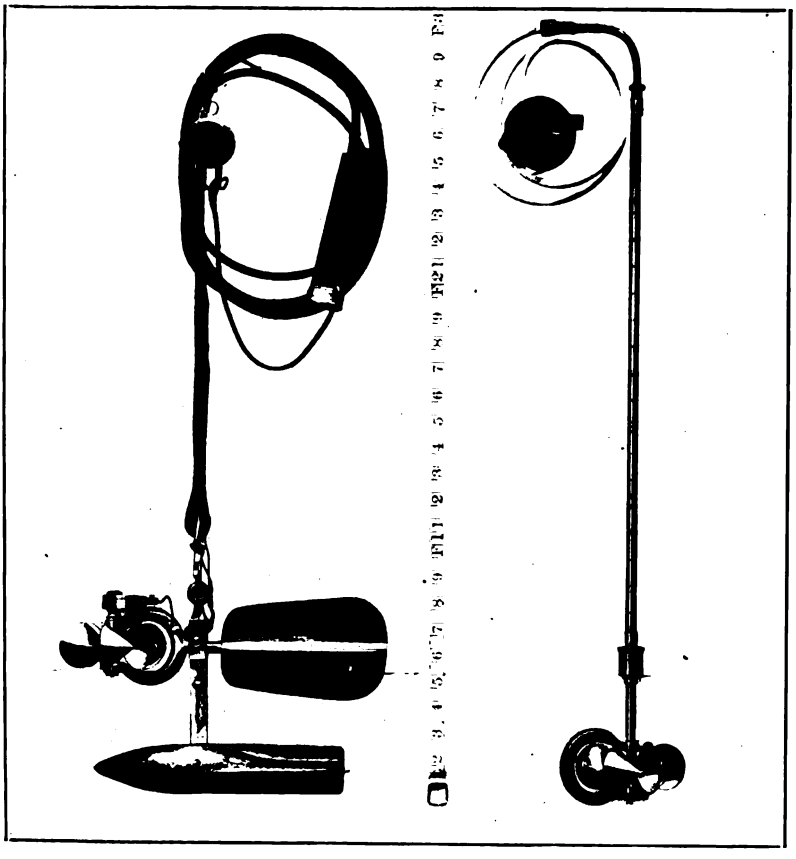
The essential parts of the current meters in use are a wheel of some type, so constructed that the impact of flowing water causes it to revolve, and a device for recording or indicating the number of revolutions. The relation between the velocity of the moving water and the revolutions of the wheel is determined for each meter. This rating is done by drawing the meter through still water for a given distance at different speeds and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity per second for any number of revolutions.

Many kinds of current meters have been constructed. They may, however, be classed in two general types—those in which the wheel is made up of a series of cups, as the Price, and those having a screw-propeller wheel, as the Haskell. Each meter has been developed for use under some special condition. In the case of the small Price meter, shown in Pl. II, *B*, which has been largely developed and extensively used by the United States Geological Survey, an attempt has been made to get an instrument which could be used under practically all conditions.

Current-meter measurements may be made from a bridge, cable, boat, or by wading, and gaging stations may be classified in accordance with such use. Fig. 1 shows a typical cable station.

In making the measurement an arbitrary number of points are laid off on a line perpendicular to the thread of the stream. The points at which the velocity and depth are observed are known as measuring points, and are usually fixed at regular intervals, varying from 2 to 20 feet, depending on the size and condition of the stream. Perpendiculars dropped from the measuring points divide the gaging section into strips. For each strip or pair of strips the mean velocity, area, and discharge are determined independently, so that conditions existing

A. CURRENT-METER RATING STATION AT LOS ANGELES, CAL.



B. PRICE CURRENT METERS.

in one part of the stream may not be extended to parts where they do not apply.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

The three principal multiple-point methods in general use are the vertical velocity-curve; 0.2 and 0.8 depth; and top, bottom, and mid-depth.

In the vertical velocity-curve method a series of velocity determinations are made in each vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve among the resulting points, the vertical velocity-curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity-curve and its axis by the depth. On account of the length of time required to

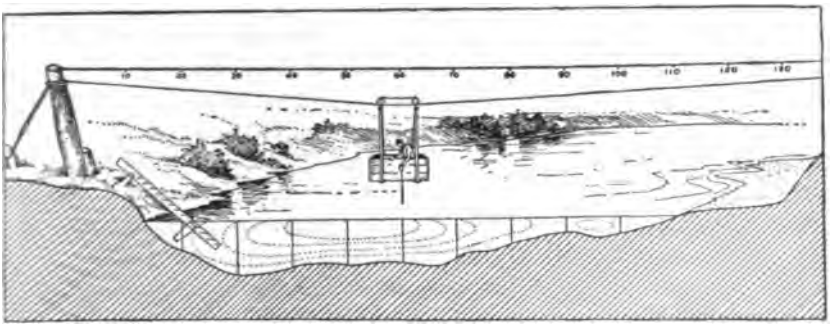


FIG. 1.—Cable station, showing section of river, car, gage, etc.

make a complete measurement by this method, its use is limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 of the depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity-curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 of the depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this second multiple-point method gives the mean velocity very closely for open-water conditions, and moreover the indications are that it holds nearly as well for ice-covered rivers.

In the third multiple-point method the meter is held at mid-depth, at 0.5 foot below the surface, and at 0.5 foot above the bottom, and the mean velocity is determined by dividing by 6 the sum of the top

velocity, four times the mid-depth velocity, and the bottom velocity. This method may be modified by observing at 0.2, 0.6, and 0.8 depth.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity, or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined.

Extensive experiments by vertical velocity-curves show that the thread of mean velocity generally occurs at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, at which point the meter is held in a majority of the measurements. A large number of vertical velocity-curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be from 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is specially adapted for flood measurements, or when the velocity is so great that the meter can not be kept at 0.6 depth.

The vertical-integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface, and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods.

The area, which is the other factor in the velocity method of determining the discharge of a stream, depends on the stage of the river, which is observed on the gage, and on the general contour of the bed of the stream, which is determined by soundings. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable or by a special sounding line or rod. For streams with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also of value in obtaining the area for use in computations of high-water measurements, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at various points of measurement, the measuring section is divided into elementary strips, as shown in fig. 1, and the mean velocity, area, and discharge are determined separately for either

a single or a double strip. The total discharge and the area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8, and vertical velocity-curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, the thickness and character of the ice, etc.

From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice. For information in regard to flow under ice cover see Water-Supply Paper No. 187.

OFFICE METHODS OF COMPUTING RUN-OFF.

There are two principal methods of determining run-off, depending on whether or not the bed of the stream is permanent.

For stations on streams with permanent beds the first step in computing the run-off is the construction of a rating table, which shows the discharge corresponding to any stage of the stream. This rating table is applied to the record of stage to determine the amount of water flowing. The construction of the rating table depends on the method used in measuring flow.

For a station at a weir or dam the basis for the rating table is some standard weir formula. The coefficients to be used in its application depend on the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and the assumed coefficient the discharge is computed for various heads and the rating table constructed.

The data necessary for the construction of a rating table for a velocity-area station are the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross section, the mean velocity of the current, and the quantity of water flowing. A thorough knowledge of the conditions at and in the vicinity of the station is also necessary.

The construction of the rating table depends on the following laws of flow for open, permanent channels: (1) The discharge will remain constant so long as conditions at or near the gaging station remain constant; (2) the discharge will be the same whenever the stream is at a given stage if the change of slope due to the rise and fall of the stream be neglected; (3) the discharge is a function of and increases gradually with the stage.

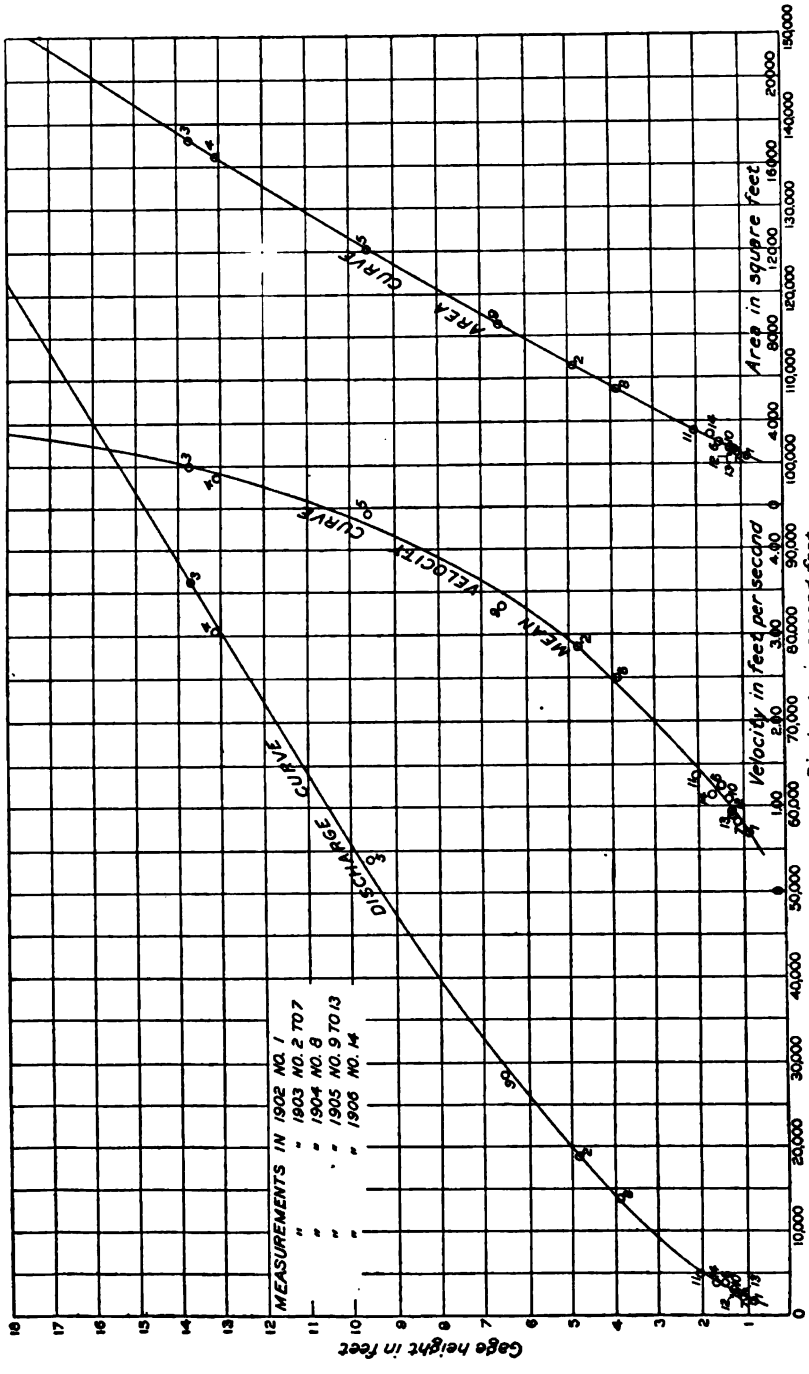


FIG. 2.—Discharge, area, and mean-velocity curves for Potomac River at Point of Rocks, Md.

The plotting of results of the various discharge measurements, using gage heights as ordinates, and discharge, mean velocity, and area as abscissas, will define curves which show the discharge, mean velocity, and area corresponding to any gage height. For the development of these curves there should be, therefore, a sufficient number of discharge measurements to cover the range of the stage of the stream. Fig. 2 shows a typical rating curve with its corresponding mean-velocity and area curves.

As the discharge is the product of two factors, the area and the mean velocity, any change in either factor will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is always concave toward the horizontal axis or on a straight line, unless the banks of the stream are overhanging.

The form of the mean-velocity curve depends chiefly on the surface slope, the roughness of the bed, and the cross section of the stream. Of these, the slope is the principal factor. In accordance with the relative changes of these factors the curve may be either a straight line, convex or concave toward either axis, or a combination of the three. From a careful study of the conditions at any gaging station the form which the vertical velocity-curve will take can be predicted, and it may be extended with reasonable certainty to stages beyond the limits of actual measurements. Its principal use is in connection with the area curve in locating errors in discharge measurements and in constructing the rating table.

The discharge curve is defined primarily by the measurements of discharge, which are studied and weighted in accordance with the local conditions existing at the time of each measurement. The curve may, however, best be located between and beyond the measurements by means of curves of area and mean velocity. The discharge curve under normal conditions is concave toward the horizontal axis and is generally parabolic in form.

In the preparation of the rating table the discharge for each tenth or half tenth on the gage is taken from the curve. The differences between successive discharges are then taken and adjusted according to the law that they shall either be constant or increasing.

The determination of daily discharge of streams with changeable beds is a difficult problem. In case there is a weir or dam available, a condition which seldom exists on streams of this class, the discharge can be determined by its use. In case of velocity-area stations frequent discharge measurements must be made if the determinations of flow are to be other than rough approximations. For stations with beds which shift slowly or are materially changed only during floods

rating tables can be prepared for periods between such changes and satisfactory results obtained with a limited number of measurements, provided that some of them are taken soon after the change occurs. For streams with continually shifting beds, such as the Colorado and Rio Grande, discharge measurements should be made every two or three days and the discharges for intervening days obtained either by interpolation modified by gage height or by Professor Stout's method, which has been described in full in the Nineteenth Annual Report of the United States Geological Survey, Part IV, page 323, and in the Engineering News of April 21, 1904. This method, or a graphical application of it, is also much used in determining the flow at stations where the bed shifts but slowly.

COOPERATION AND ACKNOWLEDGMENTS.

Assistance has been rendered or records furnished by the following, to whom special acknowledgment is due: The Maryland Geological Survey; E. Mather, president of the board of water commissioners, Harrisburg, Pa.; M. C. Nagle, chief engineer of the board of water commissioners, Harrisburg, Pa.; Cary T. Hutchinson, chief engineer of McCall Ferry Power Company; Dr. C. A. Schenck, director of the Biltmore School of Forestry.

MIDDLE ATLANTIC STATES DRAINAGES.

SUSQUEHANNA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Susquehanna River rises in Otsego Lake, in northern Otsego County, N. Y., at an elevation of 1,193 feet above tide, and flows in a general southerly direction into Chesapeake Bay. Its course is in many places extremely tortuous, crossing the State boundary between New York and Pennsylvania three times. The entire length of the river is about 500 miles, and it drains an area of 27,400 square miles, of which 21,060 square miles lie in Pennsylvania, 6,080 in New York, and 260 in Maryland.

The topography of the basin varies widely in character. In New York the stream and its tributaries flow through a rolling and in places rather broken country, bounded on the north by a mountainous area. In this part of the course its bed is of gravel or sand, with occasional rock ledges, and its banks are moderately high and not extensively subject to overflow. In Pennsylvania the river enters a mountain region, its banks are high, and it winds and twists among the parallel ranges in a bed composed generally of drift materials, gravel, sand, and bowlders. In the lower part of its course, from Marietta to Havre de Grace, it occupies a broad, deep valley,

A

B

POWER-PLANT CONSTRUCTION.

A, On Susquehanna River, near McCall Ferry, Pa.; *B*, On Shenandoah River, near Millville, W. Va.

varying in width from a few hundred feet to more than a mile, and is for the most part bounded on either shore by rocky bluffs and tablelands elevated from 100 to 500 feet above its waters.

Above the mouth of the West Branch the fall of the stream is uniform and gradual; below that point the fall becomes more irregular, and there are at many places rapids where the stream flows over a rocky bottom. The elevation of the river at the mouth of the West Branch is 400 feet above mean sea level at Havre de Grace, the distance between the two points being 125 miles. The slope is, however, extremely variable.

The fall in the lower part of the river offers exceptional opportunities for power developments, the value of which is greatly enhanced by their proximity to an unlimited market in the adjacent large cities. The hydrographic investigations of the Geological Survey along Susquehanna River have been of great assistance to engineers in investigating these powers. Pl. III, *A*, shows the construction at McCall Ferry, where the McCall Ferry Power Company is developing a large power plant. In estimating for this development the records of the Geological Survey played an important part.

In early days a complete system of canals was built along the river from the New York State line to the bay, but these have been abandoned with the establishment of railroads. The head of navigation is at the fall line, near the mouth of the stream, but various stretches are navigable for flatboats.

All available hydrographic data for Susquehanna River basin prior to 1905 have been collected and published in Water-Supply and Irrigation Papers Nos. 108 and 109. No. 108 treats principally of the quality of the water, and No. 109 gives in detail information relative to fluctuations in stage and quantity of water flowing.

SUSQUEHANNA RIVER AT BINGHAMTON, N. Y.

This station was established July 31, 1901. It is located at the Washington Street Bridge, about 800 feet upstream from the junction of Chenango and Susquehanna rivers. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 17, where are given also references to publications that contain data for previous years.

Discharge measurements of Susquehanna River at Binghamton, N. Y., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 24	C. C. Covert	207	1,260	2.33	1,670
October 5	do	298	1,100	1.98	732
November 9	do	305	1,210	2.25	1,070

Daily gage height, in feet, of Susquehanna River at Binghamton, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.62	3.3	3.1	8.12	2.91	4.0	3.12	2.08	2.2	1.98	2.75	2.9
2	3.28	3.02	3.08	6.42	2.91	3.65	3.66	2.08	2.2	2.02	2.65	2.92
3	2.95	2.72	3.0	5.45	3.46	3.33	3.26	2.1	2.15	2.02	2.6	2.85
4	3.08	2.72	6.9	5.27	5.01	3.17	2.99	2.22	2.15	2.0	2.45	2.48
5	4.02	2.62	9.3	6.45	4.31	3.0	2.79	2.08	2.1	2.0	2.4	2.5
6	4.45	2.82	6.35	7.59	3.78	3.85	2.74	2.0	2.12	2.0	2.32	3.5
7	3.55	2.85	4.6	6.72	3.58	4.23	2.44	2.0	2.1	1.95	2.28	6.12
8	3.1	2.68	4.1	5.82	3.44	3.75	2.41	2.78	2.1	2.0	2.25	3.92
9	2.88	2.55	3.75	5.42	3.28	3.15	2.36	2.38	2.02	2.02	2.22	3.48
10	2.72	2.62	3.6	7.12	3.21	3.45	2.42	2.22	2.05	1.98	2.2	3.52
11	2.88	2.68	3.5	9.35	3.28	4.05	2.64	2.15	2.02	2.0	2.22	3.8
12	2.8	2.98	3.18	8.49	3.14	4.3	2.54	2.05	1.9	1.98	2.52	3.65
13	3.0	2.42	3.08	7.19	3.01	3.55	2.42	2.05	1.9	1.98	2.4	3.42
14	3.2	2.45	2.92	6.47	2.98	3.13	2.29	2.02	.....	1.92	2.42	3.45
15	3.08	2.48	2.88	8.92	3.06	2.86	2.23	1.98	1.85	2.0	2.4	3.5
16	2.95	2.45	2.67	9.64	2.95	2.86	2.08	1.95	1.88	2.0	2.42	5.9
17	2.92	2.52	2.79	9.14	2.9	3.64	2.13	1.92	1.88	2.0	2.3	5.9
18	3.1	2.52	2.72	6.54	3.0	4.22	2.28	1.9	1.9	1.98	2.45	4.75
19	3.05	2.38	2.67	5.58	3.03	4.86	2.31	1.85	1.75	2.0	5.18	3.45
20	2.85	2.35	2.47	5.01	2.85	4.42	2.31	1.9	1.8	4.25	6.1	3.1
21	2.98	2.45	2.67	4.61	2.7	3.86	2.28	2.0	1.85	3.8	5.32	3.2
22	4.75	4.0	2.85	4.36	2.5	3.39	2.23	2.28	1.92	3.6	5.12	3.4
23	7.55	5.8	2.85	4.44	2.47	3.06	2.15	2.3	1.92	3.0	4.88	3.1
24	9.6	5.32	2.42	4.26	2.43	2.96	2.33	2.45	1.92	2.62	4.2	2.75
25	8.1	5.2	2.39	3.88	2.4	2.82	2.21	2.28	2.02	2.5	3.65	2.7
26	5.95	5.78	2.42	3.56	2.85	2.69	2.21	2.15	2.08	2.58	3.45	3.05
27	4.8	5.18	3.59	3.36	4.43	2.56	2.16	2.38	2.02	2.52	3.28	2.65
28	4.32	3.6	9.72	3.16	7.55	2.44	2.05	2.55	1.95	2.7	3.2	2.65
29	3.95	.....	9.35	3.04	7.7	2.56	2.08	3.15	1.95	2.68	3.22	2.6
30	3.62	.....	7.17	2.94	5.9	2.64	2.12	2.82	1.9	2.6	3.1	2.65
31	3.4	.....	9.42	.....	4.7	.....	2.05	2.55	.....	2.62	.....	4.5

NOTE.—River seldom freezes over at the gage. There is considerable anchor ice during January and February and parts of March and December.

Rating table for Susquehanna River at Binghamton, N. Y., for 1901 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.75	210	3.00	3,025	4.30	6,300	6.20	12,040
1.80	315	3.10	3,265	4.40	6,570	6.40	12,680
1.90	525	3.20	3,505	4.50	6,845	6.60	13,320
2.00	740	3.30	3,755	4.60	7,125	6.80	13,960
2.10	960	3.40	4,005	4.70	7,405	7.00	14,600
2.20	1,180	3.50	4,255	4.80	7,690	7.20	15,260
2.30	1,400	3.60	4,505	4.90	7,980	7.40	15,920
2.40	1,625	3.70	4,755	5.00	8,280	7.60	16,590
2.50	1,855	3.80	5,005	5.20	8,880	7.80	17,270
2.60	2,085	3.90	5,255	5.40	9,495	8.00	17,950
2.70	2,315	4.00	5,510	5.60	10,120	9.00	21,500
2.80	2,545	4.10	5,770	5.80	10,760	10.00	25,100
2.90	2,785	4.20	6,030	6.00	11,400		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1901–1906. It is well defined between gage heights 2 feet and 5 feet. The upper part of the curve is based on one measurement at 16.3 feet.

Monthly discharge of Susquehanna River at Binghamton, N. Y., for 1906.

[Drainage area, 2,400 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	23,700	2,360	5,720	2.38	2.74
February	10,800	1,510	3,740	1.56	1.62
March	24,000	1,600	6,790	2.83	3.26
April	23,800	2,880	11,500	4.79	5.34
May	16,900	1,620	4,540	1.90	2.19
June	7,840	1,720	4,070	1.70	1.90
July	4,660	850	1,710	.712	.82
August	3,380	420	1,220	.508	.59
September	1,180	210	705	.294	.33
October	6,160	567	1,580	.658	.76
November	11,700	1,180	3,470	1.45	1.62
December	11,800	1,810	4,380	1.82	2.10
The year	24,000	210	4,120	1.72	23.27

NOTE.—Values for January, February, March, and December are probably slightly in excess of the true values owing to anchor ice. Values for January to March and September and December are good. Values for April to August, and October, and November are excellent.

The following table gives the horsepower (80 per cent efficiency) per foot of fall that may be developed at different rates of discharge and shows the number of days on which the flow and the corresponding horsepower were respectively less than the amounts given in the columns for "discharge" and "horsepower:"

Discharge and horsepower table for Susquehanna River at Binghamton, N. Y., from 1901 to 1906.

Discharge in second-feet.	Horsepower (80 per cent efficiency) per foot fall.	Number of days of deficient flow.					
		1901.[a]	1902.	1903.	1904.	1905.	1906.
330	30	.....	.....	6	.....	.....	2
385	35	.....	.....	7	.....	.....	2
440	40	1	.....	13	.....	.....	5
495	45	6	.....	17	.....	.....	8
550	50	10	.....	19	.....	.....	14
600	60	29	2	23	2	.....	23
770	70	36	6	27	11	.....	41
880	80	60	10	33	28	1	54
990	90	63	14	45	31	7	64
1,100	100	74	31	54	36	15	73
1,320	120	89	52	71	55	33	85
1,540	140	101	77	90	74	66	100
1,760	160	111	96	104	91	89	125
1,980	180	117	133	119	107	117	138

[a] August 1 to December 31.

NOTE.—The minimum flow in the period August 1, 1901, to December 31, 1906, was 210 second-feet, giving 19 horsepower per foot of fall on one day in September, 1906.

SUSQUEHANNA RIVER AT WILKESBARRE, PA.

This station was established March 30, 1899. It is located at the Market Street Bridge, Wilkesbarre, Pa. Gage heights are furnished by the United States Weather Bureau. The conditions at this station and the bench marks are described in Water-Supply

Paper No. 167, page 19, where are given also references to publications that contain data for previous years.

The following discharge measurement was made July 2, 1906:

Area, 4,800 square feet; gage height, 5.51 feet; discharge, 9,400 second-feet.

Daily gage height, in feet, of Susquehanna River at Wilkesbarre, Pa., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	8.0	6.0	7.6	17.7	5.6	8.6	5.7	3.4	4.1	2.4	5.3	5.4
2	7.0	5.9	6.4	14.8	5.4	8.5	5.5	3.2	3.7	2.8	5.3	5.2
3	6.2	5.6	5.2	12.7	5.4	6.8	7.5	3.3	3.5	2.7	5.4	5.0
4	6.0	6.7	11.4	11.0	5.4	6.2	8.5	3.3	4.0	2.7	5.2	5.0
5	6.1	6.1	13.0	11.1	7.0	5.7	7.1	3.8	3.3	3.1	5.0	4.8
6	6.6	5.7	11.6	12.8	7.4	5.4	6.1	3.4	3.1	3.4	4.8	4.8
7	7.1	5.3	10.8	14.2	6.7	7.4	5.4	4.1	3.1	3.2	4.6	6.2
8	6.3	4.7	8.7	12.6	6.4	7.8	5.0	4.1	2.8	3.1	4.4	9.9
9	5.8	4.8	7.4	11.0	6.0	6.9	4.7	4.2	3.0	3.1	4.2	8.8
10	6.3	5.1	6.9	11.6	5.9	6.2	4.5	5.0	2.9	3.1	4.0	7.0
11	5.9	5.0	6.4	14.8	5.6	6.5	4.4	4.5	2.8	3.3	3.9	6.3
12	6.2	5.1	6.0	15.6	5.6	6.6	4.5	3.9	2.7	3.1	4.0	6.3
13	5.9	4.9	5.8	14.3	5.6	6.4	4.8	4.3	2.7	3.2	4.1	8.0
14	5.8	5.2	5.4	12.5	5.3	6.1	4.7	4.0	2.7	3.2	4.4	9.2
15	5.7	5.1	5.3	12.4	5.2	5.4	4.4	3.7	2.7	3.3	4.5	8.6
16	5.4	4.7	5.0	15.1	5.2	4.9	4.1	3.3	2.6	3.3	4.7	7.7
17	5.4	4.1	5.0	15.2	5.2	5.3	3.9	3.2	2.6	3.2	4.5	9.3
18	4.9	4.2	4.8	13.4	5.3	7.2	4.0	3.1	2.6	3.1	4.4	9.2
19	5.0	4.3	4.6	11.4	5.7	9.9	4.1	3.0	2.5	3.0	5.7	8.0
20	5.1	4.4	4.4	9.8	6.0	10.2	4.2	2.8	2.5	3.2	8.5	6.6
21	5.1	4.3	4.2	8.8	5.6	10.0	4.2	2.8	2.6	5.5	9.4	5.9
22	5.2	5.3	4.2	8.1	5.2	8.6	4.2	2.9	2.6	8.6	9.0	5.8
23	6.2	5.6	4.0	7.6	4.8	7.3	4.0	3.7	2.6	7.2	9.1	6.2
24	11.9	10.4	4.0	8.5	4.4	6.4	3.8	3.7	2.5	6.6	8.3	5.9
25	14.8	8.8	4.1	8.7	4.2	5.8	4.0	3.8	2.5	5.7	7.5	8.2
26	12.6	9.3	4.2	8.2	4.0	5.3	3.7	3.7	2.6	5.5	6.7	7.4
27	10.3	8.8	4.3	7.4	4.0	5.0	3.6	3.9	2.9	5.1	6.3	6.9
28	8.3	8.3	9.8	6.8	5.1	4.7	3.5	4.1	2.8	5.1	5.8	7.1
29	7.5	.....	17.4	6.3	14.0	4.4	3.4	4.0	2.8	5.1	5.6	8.2
30	6.8	.....	15.3	5.9	12.6	5.9	3.2	4.3	2.8	5.2	5.5	7.5
31	6.4	.....	15.0	.....	10.4	.....	3.5	4.7	.....	5.2	.....	6.2

Rating table for Susquehanna River at Wilkesbarre, Pa., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	1,050	3.70	3,540	5.00	7,150	7.60	17,130
2.50	1,180	3.80	3,780	5.20	7,800	7.80	18,010
2.60	1,320	3.90	4,030	5.40	8,490	8.00	18,910
2.70	1,470	4.00	4,280	5.60	9,210	9.00	23,700
2.80	1,630	4.10	4,540	5.80	9,950	10.00	28,760
2.90	1,810	4.20	4,800	6.00	10,710	11.00	33,960
3.00	2,000	4.30	5,070	6.20	11,470	12.00	39,510
3.10	2,200	4.40	5,340	6.40	12,240	13.00	45,400
3.20	2,410	4.50	5,620	6.60	13,020	14.00	51,700
3.30	2,620	4.60	5,910	6.80	13,810	15.00	58,400
3.40	2,840	4.70	6,210	7.00	14,610	16.00	65,500
3.50	3,070	4.80	6,520	7.20	15,430	17.00	73,000
3.60	3,300	4.90	6,830	7.40	16,270	18.00	80,900

NOTE.—The above table is applicable only for open-channel conditions. It is based on 26 discharge measurements made during 1899–1906. It is well defined between gage heights 2.2 feet and 21 feet. Below gage height 6 feet the table is the same as for 1904.

Monthly discharge of Susquehanna River at Wilkesbarre, Pa., for 1906.

[Drainage area, 9,810 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	57,000	6,830	15,400	1.57	1.81
February	30,800	4,540	10,700	1.09	1.14
March	76,100	4,280	18,700	1.91	2.20
April	78,500	10,300	37,400	3.81	4.25
May	51,700	4,280	12,100	1.23	1.42
June	29,800	5,340	13,900	1.42	1.58
July	21,200	2,410	6,490	.662	.76
August	7,150	1,630	3,660	.373	.43
September	4,540	1,180	1,870	.191	.21
October	21,700	1,050	5,130	.523	.60
November	25,700	4,030	10,100	1.03	1.15
December	28,200	6,520	15,000	1.53	1.76
The year	78,500	1,050	12,500	1.28	17.31

NOTE.—Owing to ice there may have been considerable backwater during the last week in December. The discharge was computed for open-channel conditions. Values for 1906 are excellent, with the exception of those for September and December, which are good.

SUSQUEHANNA RIVER AT DANVILLE, PA.

This station was established March 25, 1899. It is located at Mill Street Bridge, 600 feet south of the public square, Danville, Pa., near the Pennsylvania Railroad station, South Danville. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 23, where are given also references to publications that contain data for previous years.

The following discharge measurement was made June 30, 1906:

Width, 870 feet; area, 3,560 square feet; gage height, 4.23 feet; discharge, 9,360 second-feet.

Daily gage height, in feet, of Susquehanna River at Danville, Pa., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.7	5.0	6.1	14.2	5.0	7.4	5.1	3.1	3.9	2.5	4.6	4.3
2	6.1	4.9	5.4	12.5	4.8	6.6	4.8	3.0	3.5	2.5	4.6	4.3
3	5.5	4.5	5.5	10.6	4.6	6.4	4.6	3.0	3.7	2.6	4.6	4.1
4	5.0	4.2	9.25	9.25	4.9	6.3	5.3	3.0	3.3	2.5	4.6	4.3
5	5.2	.....	10.7	8.8	4.6	5.5	6.3	3.3	3.1	2.9	4.4	4.0
6	5.3	.....	9.75	10.3	4.6	4.7	5.5	3.4	3.0	3.1	4.3	4.6
7	5.8	.....	8.8	11.4	5.8	5.2	5.0	3.2	2.9	3.1	4.1	5.7
8	5.4	.....	7.8	11.0	5.6	6.3	4.5	3.6	2.8	3.0	3.9	6.5
9	5.0	.....	6.8	9.3	5.0	6.0	4.2	3.7	2.8	2.9	3.8	7.1
10	4.5	.....	6.2	9.2	5.0	5.5	4.0	3.9	2.8	2.8	3.7	7.6
11	4.4	.....	6.0	11.8	4.8	5.1	4.0	4.1	[illegible]	[illegible]	3.7	6.0
12	4.3	.....	5.3	12.7	4.6	5.4	3.8	3.7	2.7	3.0	3.6	5.3
13	4.0	.....	5.3	11.8	4.6	5.1	3.9	3.4	2.6	3.0	3.5	5.3
14	4.2	.....	5.0	10.5	4.5	5.2	4.1	3.7	2.5	2.9	3.5	5.2
15	4.3	.....	4.1	12.3	4.3	4.8	3.9	3.5	2.5	2.9	3.8	5.1
16	4.5	.....	4.5	13.2	4.3	4.4	.....	3.2	2.1	2.9	3.9	5.1
17	4.5	.....	4.5	12.7	4.4	4.3	.....	3.0	2.4	2.9	4.0	5.7
18	4.5	.....	4.3	11.5	4.3	5.4	.....	2.9	2.4	2.9	4.0	7.6
19	4.3	.....	4.3	9.75	4.5	8.75	.....	2.8	2.3	2.8	4.1	6.8
20	4.2	.....	4.0	8.7	4.8	9.4	.....	2.7	2.3	2.8	5.4	5.6
21	4.4	.....	3.8	7.45	4.7	8.8	.....	2.6	2.3	3.3	7.5	5.5
22	5.1	7.9	3.9	7.1	4.6	8.6	.....	2.7	2.4	6.6	7.5	5.2
23	7.3	12.0	3.8	7.0	4.2	6.9	.....	2.7	2.4	6.5	7.3	5.0
24	9.3	7.5	3.7	6.8	3.9	6.0	.....	3.3	2.4	5.9	7.0	4.7
25	11.6	7.4	3.8	6.9	3.8	5.4	.....	3.3	2.3	5.2	6.5	4.3

Daily gage height, in feet, of Susquehanna River at Danville, Pa., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26	11.0	7.8	3.8	6.6	3.6	4.9	.....	3.5	2.3	4.8	5.7	4.1
27	9.1	7.5	3.7	6.3	3.7	4.5	.....	3.6	2.4	4.6	5.4	3.7
28	7.5	6.6	6.65	5.9	4.1	4.4	.....	3.8	2.5	4.5	5.1	3.6
29	6.7	.....	13.5	5.5	10.1	4.1	.....	3.6	2.5	4.3	4.7	3.4
30	5.9	.....	12.8	5.1	10.1	4.1	.....	3.5	2.5	4.4	4.5	3.7
31	5.6	.....	12.5	.....	8.7	.....	.....	3.8	.....	4.5	.....	4.8

NOTE.—River frozen February 5-21; backwater, February 23.

Rating table for Susquehanna River at Danville, Pa., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	1,640	3.40	5,600	4.70	11,500	7.00	24,500
2.20	1,840	3.50	6,000	4.80	12,020	7.20	25,720
2.30	2,060	3.60	6,400	4.90	12,540	7.40	26,960
2.40	2,300	3.70	6,800	5.00	13,060	7.60	28,260
2.50	2,560	3.80	7,220	5.20	14,150	7.80	29,580
2.60	2,840	3.90	7,660	5.40	15,250	8.00	30,940
2.70	3,140	4.00	8,100	5.60	16,350	9.00	38,200
2.80	3,460	4.10	8,560	5.80	17,450	10.00	46,220
2.90	3,780	4.20	9,040	6.00	18,550	11.00	54,920
3.00	4,120	4.30	9,520	6.20	19,710	12.00	64,320
3.10	4,480	4.40	10,000	6.40	20,900	13.00	74,420
3.20	4,840	4.50	10,500	6.60	22,100	14.00	85,120
3.30	5,220	4.60	11,000	6.80	23,300		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 23 discharge measurements made during 1899-1906. It is well defined between gage heights 1.5 feet and 19 feet.

Monthly discharge of Susquehanna River at Danville, Pa., for 1906.

[Drainage area, 11,100 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	60,500	8,100	18,800	1.69	1.95
February	29,600	5,500	13,000	1.17	1.22
March	79,700	6,800	22,800	2.05	2.36
April	87,300	13,600	44,800	4.04	4.51
May	47,100	6,400	14,000	1.26	1.45
June	41,300	8,560	18,200	1.64	1.83
July	20,300	3,000	8,100	.730	.84
August	8,560	2,840	5,330	.480	.55
September	7,660	1,640	3,200	.288	.32
October	22,100	2,560	7,000	.631	.73
November	27,600	6,000	12,300	1.11	1.24
December	28,300	5,600	14,000	1.26	1.45
The year	87,300	1,640	15,100	1.36	18.45

NOTE.—The mean and minimum flows for February and July were determined by comparison with the flow at Wilkesbarre. Values for 1906 are excellent, with the exception of February and July, which are good.

The following table gives the horsepower (80 per cent efficiency) per foot of fall that may be developed at different rates of discharge and shows the number of days on which the flow and the corresponding horsepower were, respectively, less than the amounts given in the columns for "discharge" and "horsepower."

Discharge and horsepower table for Susquehanna River at Danville, Pa., from 1899 to 1906.

Discharge in second-feet.	Horsepower (80 per cent efficiency) per foot fall.	Number of days of deficient flow.							
		1899.[a]	1900.	1901.	1902.	1903.	1904.[b]	1905.	1906.
880	80	.....	3	.....	.....	.....	.....	.....	.....
990	90	.....	30	.....	.....	.....	.....	.....	.....
1,100	100	.....	30	.....	.....	.....	.....	.....	.....
1,320	120	31	55	.....	.....	.....	.....	.....	.....
1,540	140	42	75	.....	.....	.....	.....	.....	.....
1,760	160	59	89	.....	.....	.....	.....	.....	1
1,980	180	71	104	.....	.....	.....	.....	.....	1
2,200	200	83	120	.....	.....	.....	.....	.....	6
2,750	250	127	147	14	6	6	8	.....	21
3,300	300	137	154	29	12	15	39	3	30
3,850	350	142	163	44	16	25	67	10	50
4,400	400	158	173	71	32	39	83	23	61
4,950	450	169	179	91	48	50	95	37	70
5,500	500	173	182	113	53	58	111	60	81
6,600	600	193	186	151	91	75	139	96	105
7,700	700	207	194	171	111	98	156	121	138

[a] March 25 to December 31, 1899.
[b] No records at Danville for 1904. These results are obtained by using the Wilkesbarre records, increased in proportion to the drainage areas of the two stations.

NOTE.—During the period covered by the above table the minimum flow was 830 second-feet, giving 75 horsepower per foot of fall, on three consecutive days in September, 1900.

SUSQUEHANNA RIVER AT HARRISBURG, PA.

Regular daily observations of the stage of Susquehanna River at Harrisburg were started in 1890 by E. Mather, president of the Harrisburg water board. During the first half of 1906 the gage heights were furnished by Mr. Mather and during the last half by the United States Weather Bureau, which now maintains this station. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 26, where are given also references to publications that contain data for previous years.

The following discharge measurement was made June 29, 1906:

Width, 2,500 feet; area, 10,100 square feet; gage height, 2.44 feet; discharge, 17,100 second-feet.

Daily gage height, in feet, of Susquehanna River at Harrisburg, Pa., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.2	3.9	3.65	10.75	3.35	5.45	2.2	1.7	2.3	1.0	2.8	2.6
2	4.95	3.4	3.5	10.6	3.2	4.6	2.75	1.7	2.2	1.0	2.8	2.5
3	4.4	3.3	3.0	9.1	3.05	4.0	2.45	1.6	2.0	1.0	2.8	2.4
4	4.4	2.8	3.7	7.9	3.05	3.6	2.3	1.7	2.1	1.0	2.7	2.2
5	4.85	2.7	7.5	7.2	3.1	3.2	3.4	1.8	2.5	1.8	2.7	2.1
6	5.15	2.2	7.0	7.3	3.15	3.1	3.3	2.2	2.2	2.2	2.5	2.3
7	5.1	1.8	6.1	8.3	3.6	2.85	2.85	2.2	2.1	1.9	2.4	2.2
8	4.9	1.9	5.8	8.25	3.4	2.9	2.55	2.1	1.9	1.8	2.3	2.3
9	4.1	2.0	4.8	7.4	3.2	3.5	2.3	2.2	1.7	1.6	2.2	4.6
10	3.65	2.0	4.2	7.2	3.0	3.8	2.2	2.3	1.6	1.6	2.1	4.6
11	3.0	2.05	4.0	8.95	3.0	3.3	2.05	2.3	1.5	1.4	2.0	3.9
12	3.0	2.1	3.6	10.1	2.85	2.9	2.0	2.9	1.5	1.4	2.0	3.5
13	3.0	1.9	3.5	9.5	2.8	2.95	1.9	3.7	1.4	1.5	1.9	3.6
14	3.1	2.15	3.5	8.2	2.7	2.8	1.75	3.2	1.4	1.5	1.9	3.5
15	3.2	2.5	3.2	8.85	2.6	2.7	1.9	2.8	1.3	1.4	2.0	3.5

Daily gage height, in feet, of Susquehanna River at Harrisburg, Pa., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	3.35	2.5	3.1	11.2	2.7	2.6	1.8	2.5	1.2	1.3	2.0	3.3
17	3.1	2.1	3.1	9.9	2.5	2.4	1.8	2.1	1.1	1.3	2.1	3.4
18	3.55	2.2	2.9	8.9	2.55	2.7	1.8	1.9	1.1	1.3	2.1	3.9
19	3.5	2.0	2.7	7.8	2.5	3.9	1.7	1.7	1.0	1.3	2.1	4.5
20	3.3	2.0	2.7	6.6	2.7	6.8	2.4	1.6	1.1	2.0	2.2	4.1
21	3.3	2.15	2.5	5.8	2.75	5.9	2.2	2.1	1.0	3.5	3.2	3.8
22	3.6	2.7	2.5	5.35	2.6	5.4	2.2	2.3	1.0	4.4	4.2	3.9
23	3.55	2.55	2.6	4.9	2.45	4.9	2.1	2.0	1.0	5.1	4.2	3.8
24	4.5	3.9	2.3	4.6	2.3	4.2	2.0	2.0	.9	4.4	4.2	3.3
25	9.15	3.75	2.35	4.8	2.1	3.7	1.9	2.4	.9	4.0	4.0	2.9
26	8.75	4.3	2.4	4.6	2.05	3.3	1.8	2.2	1.0	3.6	3.7	2.9
27	7.4	4.6	2.3	4.5	2.15	2.95	1.8	2.2	1.0	3.3	3.3	2.5
28	6.35	4.0	3.1	4.25	2.25	2.7	1.7	2.8	1.0	3.0	3.0	2.1
29	5.3	.....	8.05	3.85	3.8	2.45	1.7	3.2	1.0	2.9	2.9	2.2
30	4.7	.....	10.2	3.6	7.2	2.35	1.7	2.8	1.0	2.9	2.7	2.5
31	4.4	.....	9.5	.....	6.6	.....	1.7	2.4	.....	2.8	.....	3.0

NOTE.—Ice conditions existed during portions of January, February, and March.

Rating table for Susquehanna River at Harrisburg, Pa., for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	6,030	2.20	15,050	3.50	29,430	5.60	61,700
1.00	6,550	2.30	15,980	3.60	30,800	5.80	65,000
1.10	7,090	2.40	16,950	3.70	32,200	6.00	68,400
1.20	7,650	2.50	17,960	3.80	33,600	6.20	71,900
1.30	8,240	2.60	19,010	3.90	35,000	6.40	75,500
1.40	8,850	2.70	20,100	4.00	36,400	6.60	79,200
1.50	9,520	2.80	21,210	4.20	39,200	6.80	82,900
1.60	10,200	2.90	22,340	4.40	42,200	7.00	86,600
1.70	10,930	3.00	23,480	4.60	45,400	8.00	105,600
1.80	11,700	3.10	24,620	4.80	48,600	9.00	125,100
1.90	12,500	3.20	25,760	5.00	51,900	10.00	145,600
2.00	13,300	3.30	26,910	5.20	55,100	11.00	167,500
2.10	14,160	3.40	28,130	5.40	58,400	12.00	190,500

NOTE.—The above table is applicable only for open-channel conditions. It is based on 45 discharge measurements made during 1897-1906. It is well defined throughout. Below 7 feet the table is the same as for 1904.

Monthly discharge of Susquehanna River at Harrisburg, Pa., for 1906.

[Drainage area, 24,000 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	128,000	23,500	45,800	1.91	2.20
February	45,400	11,700	21,000	.875	.91
March	150,000	16,000	42,700	1.78	2.05
April	172,000	30,800	95,300	3.97	4.43
May	90,400	13,700	25,600	1.07	1.23
June	82,900	16,500	32,200	1.34	1.50
July	28,100	10,900	14,800	.617	.71
August	32,200	10,200	16,200	.675	.78
September	18,000	6,030	9,470	.395	.44
October	53,500	6,550	17,400	.725	.84
November	39,200	12,500	20,800	.867	.97
December	45,400	14,200	26,100	1.09	1.26
The year	172,000	6,030	30,600	1.28	17.32

NOTE.—The computation of discharge for January, February, and March is based on open-channel conditions; the effect of ice was immaterial. Values for 1906 are excellent.

The following table gives the horsepower (80 per cent efficiency) per foot of fall that may be developed at different rates of discharge and shows the number of days on which the flow and the corresponding horsepower were respectively less than the amounts given in the columns for "discharge" and "horsepower."

Discharge and horsepower table for Susquehanna River at Harrisburg, Pa., from 1891 to 1906.

Discharge in second-feet.	Horsepower (80 per cent efficiency) per foot fall.	Number of days of deficient flow.							
		1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.
2,750	250	.....	.....	.....	.....	4	.....	.....	.....
3,300	300	.....	.....	.....	2	20	9	.....	.....
3,850	350	.....	.....	11	10	50	18	.....	.....
4,400	400	.....	9	16	11	62	22	3	.....
4,950	450	.....	14	22	14	89	28	21	7
5,500	500	.....	16	24	18	104	31	32	15
6,600	600	.....	37	31	31	133	39	53	33
7,700	700	.....	49	34	47	139	42	66	37
8,800	800	.....	59	40	59	158	48	80	43
9,900	900	.....	76	55	72	169	70	94	50
11,000	1,000	10	88	75	78	172	93	104	57
12,100	1,100	14	100	92	82	178	108	117	61
13,200	1,200	18	106	96	84	183	114	119	68
14,300	1,300	45	124	134	93	188	125	133	85
15,400	1,400	54	132	142	96	188	128	138	89
16,500	1,500	72	144	158	108	192	141	142	105
17,600	1,600	78	150	160	116	195	146	144	109
18,700	1,700	90	163	178	127	201	158	160	120
19,800	1,800	102	166	181	135	203	163	162	122
20,900	1,900	122	174	194	144	213	179	180	137
22,000	2,000	127	187	203	153	218	183	185	139

Discharge in second-feet.	Horsepower (80 per cent efficiency) per foot fall.	Number of days of deficient flow.							
		1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
2,750	250	.....	23	.....	.....	.....	.....	.....	.....
3,300	300	3	38	.....	.....	.....	.....	.....	.....
3,850	350	17	44	.....	.....	.....	.....	.....	.....
4,400	400	28	53	.....	.....	.....	.....	.....	.....
4,950	450	48	72	.....	.....	.....	.....	.....	.....
5,500	500	62	84	.....	.....	.....	.....	.....	.....
6,600	600	83	118	1	13	3	5	.....	15
7,700	700	100	134	7	19	5	26	.....	19
8,800	800	119	148	15	28	16	53	.....	24
9,900	900	139	154	28	36	21	82	.....	33
11,000	1,000	147	157	55	54	36	116	15	48
12,100	1,100	153	164	86	65	42	142	32	58
13,200	1,200	157	187	97	73	52	163	60	68
14,300	1,300	164	180	121	83	72	174	86	100
15,400	1,400	167	190	125	96	84	179	100	122
16,500	1,500	175	198	141	111	101	185	124	135
17,600	1,600	181	205	150	123	106	188	143	147
18,700	1,700	196	214	161	126	109	200	160	162
19,800	1,800	201	217	171	138	122	203	170	167
20,900	1,900	210	220	182	146	128	206	180	182
22,000	2,000	215	224	186	151	141	209	187	195

NOTE.—From 1891 to 1906 the minimum flow was 2,330 second-feet, giving 212 horsepower, on two consecutive days in September, 1900. For days on which no gage readings were made at this station the table is based on discharges at McCall Ferry, with appropriate reduction. No correction has been made for ice except in 1904. In general the results would probably be affected only slightly by ice conditions.

SUSQUEHANNA RIVER NEAR M'CALL FERRY, PA.

This station was established May 17, 1902, by Boyd Ehle, who furnishes the gage heights. It is located at a narrow and rocky part of Susquehanna River, about 20 miles above its mouth and 1 mile above the village of McCall Ferry.

The measurements at this station have been referred to two permanent gages, designated as Nos. 2 and 5, which give elevations directly above sea level. No. 2 is about three-fourths mile below the village of McCall Ferry, in the tailrace of the proposed power house. It was read daily from June, 1902, through February, 1906, when operations at the dam began to cause backwater at the gage. Gage No. 5 is about 2 miles below McCall Ferry, at the foot of Cullys Falls, and is so located as to be entirely out of the influence of the dam. Regular readings on this gage were not made until March 1, 1906, since which time it has been used exclusively. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 29, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Susquehanna River near McCall Ferry, Pa., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	107.17	106.24	105.8	116.0	105.7	109.2	103.1	103.0	103.8	101.3	104.2	104.0
2	105.97	105.88	105.8	117.8	105.4	107.7	102.8	102.9	103.7	101.8	104.2	104.0
3	106.15	105.02	105.6	115.9	105.3	106.6	103.1	103.1	103.6	101.5	104.1	104.0
4	106.96	104.41	110.7	113.9	105.2	106.0	103.0	103.3	103.2	101.0	104.0	103.5
5	106.75	104.33	111.1	112.0	105.0	105.6	103.8	104.9	103.2	102.5	104.0	103.5
6	108.28	103.90	112.0	111.4	105.0	105.1	103.0	103.7	104.0	104.2	104.0	103.5
7	108.28	102.98	111.0	112.0	105.1	104.9	104.8	103.7	103.6	103.2	103.9	103.5
8	107.89	102.57	109.6	113.4	105.9	104.7	104.2	103.5	103.2	103.0	103.5	103.2
9	107.17	102.41	108.8	112.5	105.7	104.8	103.9	103.6	102.8	102.4	103.2	103.2
10	105.29	102.81	107.5	113.0	105.1	105.9	103.5	103.6	102.5	102.2	103.3	106.8
11	105.29	102.98	.....	113.3	104.9	105.9	103.5	103.6	103.0	102.0	103.3	107.0
12	104.55	102.81	106.0	115.9	104.8	105.0	103.4	103.8	103.4	101.8	103.0	105.7
13	104.94	102.73	105.9	115.8	104.6	104.5	103.0	104.6	102.0	101.8	102.6	105.2
14	104.94	103.14	105.8	114.2	104.6	104.8	102.9	105.2	102.1	101.8	102.5	105.2
15	105.11	103.56	105.5	114.0	104.5	104.6	102.8	104.9	102.0	102.1	102.5	105.0
16	105.11	104.07	105.9	119.0	104.4	104.5	102.9	104.5	102.4	101.7	102.5	105.0
17	105.46	103.64	105.1	117.0	104.3	105.1	103.2	103.8	102.4	101.7	102.5	105.0
18	105.62	103.39	104.8	115.3	104.2	104.4	103.0	103.5	102.4	101.6	102.6	105.8
19	105.62	103.47	104.8	113.4	104.1	105.5	102.9	103.0	102.0	101.4	102.6	106.5
20	105.37	103.39	104.8	111.6	104.1	108.3	102.7	102.9	101.9	102.0	102.6	106.7
21	105.29	103.64	104.1	110.0	104.1	110.0	103.5	102.8	101.9	104.6	103.0	106.0
22	105.20	104.94	104.3	109.0	104.2	109.5	103.4	103.7	101.5	105.4	105.0	106.2
23	105.29	105.62	104.1	108.1	104.1	108.6	103.5	103.9	101.5	106.8	106.0	105.9
24	105.62	106.34	103.9	107.6	103.7	107.2	103.4	103.2	101.2	107.4	106.0	104.9
25	110.77	105.97	103.8	107.4	103.3	106.2	103.3	102.9	101.5	106.4	106.0	104.4
26	114.73	107.76	103.6	107.3	103.1	105.6	103.2	103.8	101.1	105.6	105.6	103.6
27	112.84	107.40	103.7	107.3	102.9	105.1	103.0	103.6	101.2	105.2	105.2	103.5
28	110.65	106.64	104.7	106.9	103.1	104.5	103.0	103.9	101.3	104.8	104.8	103.4
29	109.45	.....	107.5	106.2	103.4	103.9	103.2	104.5	101.4	104.4	104.4	103.6
30	107.89	.....	116.6	106.0	108.0	103.4	103.1	104.7	101.4	104.0	104.0	103.8
31	106.96	.....	115.8	.....	110.7	.....	103.0	104.2	.....	104.0	.....	104.0

NOTE.—All above gage heights refer to Cullys Falls gage.

Rating table for Susquehanna River near McCall Ferry, Pa., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
101.00	5,300	102.80	14,990	105.20	32,600	111.50	94,300
101.10	5,740	102.90	15,640	105.40	34,240	112.00	100,500
101.20	6,190	103.00	16,300	105.60	35,920	112.50	106,980
101.30	6,650	103.10	16,960	105.80	37,640	113.00	113,700
101.40	7,120	103.20	17,640	106.00	39,400	113.50	120,660
101.50	7,600	103.30	18,320	106.20	41,160	114.00	127,800
101.60	8,090	103.40	19,000	106.40	42,940	114.50	135,000
101.70	8,600	103.50	19,700	106.60	44,740	115.00	142,300
101.80	9,120	103.60	20,400	106.80	46,560	115.50	149,600
101.90	9,650	103.70	21,120	107.00	48,400	116.00	157,000
102.00	10,200	103.80	21,840	107.50	53,000	116.50	164,500
102.10	10,760	103.90	22,560	108.00	57,600	117.00	172,000
102.20	11,330	104.00	23,300	108.50	62,300	117.50	179,600
102.30	11,910	104.20	24,800	109.00	67,100	118.00	187,300
102.40	12,500	104.40	26,320	109.50	71,960	119.00	202,900
102.50	13,110	104.60	27,860	110.00	77,000	120.00	218,800
102.60	13,720	104.80	29,420	110.50	82,500		
102.70	14,350	105.00	31,000	111.00	88,300		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 37 discharge measurements made during 1902-1904. It is well defined above gage height 10.12 feet.

Monthly discharge of Susquehanna River near McCall Ferry, Pa., for 1906.

[Drainage area, 26,800 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	138,000	27,400	49,700	1.85	2.13
February	55,400	12,500	26,800	1.00	1.04
March	166,000	20,400	51,000	1.90	2.19
April	203,000	39,400	107,000	3.99	4.45
May	84,800	15,600	29,900	1.12	1.29
June	77,000	19,000	39,200	1.46	1.63
July	31,000	14,400	18,600	.694	.80
August	32,600	15,000	21,600	.806	.93
September	23,300	5,740	12,800	.478	.53
October	52,100	5,300	19,000	.709	.82
November	39,400	13,100	22,600	.843	.94
December	48,400	17,600	29,100	1.09	1.26
The year	203,000	5,300	35,600	1.33	18.01

NOTE.—Values for entire year are excellent.

CHENANGO RIVER AT BINGHAMTON, N. Y.

This station, which was established July 31, 1901, is located at the Court Street Bridge, Binghamton. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 32, where are given also references to publications that contain data for previous years.

Discharge measurements of Chenango River at Binghamton, N. Y., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
October 3	C. C. Covert	225	464	5.30	396
November 8	do	300	681	5.95	1,050

Daily gage height, in feet, of Chenango River at Binghamton, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.65	6.88	5.99	11.36	6.32	7.25	7.23	5.58	5.5	5.28	6.68	6.5
2	7.32	6.6	6.22	9.74	6.22	6.88	7.36	5.5	5.4	5.28	6.55	6.35
3	6.92	5.82	6.19	8.81	8.22	6.58	6.76	5.5	5.4	5.28	6.38	6.4[illegible]
4	7.1	6.02	11.02	8.71	8.56	6.43	6.46	5.68	5.5	5.28	6.25	5.92
5	8.1	6.22	12.47	10.23	7.64	6.25	6.33	6.2	5.42	5.3	6.18	5.[illegible]
6	7.78	6.12	9.09	11.07	7.52	7.13	6.21	5.9	5.42	5.28	6.12	6.78
7	7.15	6.0	7.62	9.9	7.26	7.20	6.01	6.2	5.4	5.25	6.02	10.05
8	7.0	6.02	5.72	9.07	6.96	6.84	5.93	6.02	5.3	5.72	5.9	7.4[illegible]
9	6.52	5.92	6.92	8.73	6.76	6.34	5.89	5.82	5.28	5.65	5.88	6.58
10	6.3	5.95	6.72	10.37	6.94	6.72	6.76	5.45	5.15	5.58	5.82	7.25
11	6.4	5.95	6.47	12.9	6.76	7.07	7.31	5.62	5.2	5.6	5.8	7.46
12	6.5	5.98	6.39	11.83	6.56	7.27	7.03	5.72	5.2	5.75	6.28	7.12
13	6.5	5.88	6.27	10.45	6.49	6.57	6.53	5.75	5.0	5.6	6.22	6.85
14	6.6	5.95	6.19	9.75	6.99	6.24	6.26	5.58	5.12	5.6	6.22	6.86
15	6.5	5.82	6.08	12.07	7.06	6.12	6.09	5.52	5.25	5.5	6.1	6.9
16	6.45	5.82	6.04	13.03	6.46	6.22	5.96	5.42	5.22	5.48	6.08	10.4
17	6.62	5.8	5.98	11.3	6.38	6.57	5.93	5.42	5.05	5.42	6.0	9.6
18	6.6	5.75	5.94	9.6	6.68	7.17	6.01	5.38	5.08	5.32	6.18	8.35
19	6.5	5.8	5.91	8.73	6.63	7.97	5.93	5.3	4.95	5.3	9.12	7.05
20	6.4	5.75	5.71	8.17	6.33	7.94	5.88	5.3	5.0	8.7	9.2	6.7
21	6.68	5.87	5.98	7.73	6.21	7.27	5.9	5.82	5.3	8.3	8.5	6.9
22	8.9	8.25	6.06	7.6	6.05	6.87	5.8	6.18	5.4	7.5	8.38	7.1
23	11.5	9.02	5.96	7.65	5.95	6.54	5.68	5.8	5.32	6.85	8.25	6.8
24	13.45	8.29	5.91	7.4	5.93	6.40	5.65	5.8	5.38	6.48	7.42	6.25
25	11.65	8.35	5.81	7.03	5.88	6.24	5.58	5.52	5.48	6.42	7.05	6.0
26	9.35	8.89	5.78	6.79	6.33	6.12	5.5	5.4	5.38	6.58	6.85	6.05
27	8.3	7.99	6.84	6.59	8.85	6.02	5.48	5.5	5.32	6.35	6.7	6.2
28	7.75	6.37	13.41	6.52	11.78	5.93	5.48	6.15	5.3	6.52	6.7	6.25
29	7.32	.....	12.66	6.32	10.98	6.06	5.45	6.15	5.28	6.55	6.7	6.3
30	6.88	.....	10.51	6.26	8.93	6.11	5.5	5.82	5.2	6.48	6.6	6.3
31	6.95	.....	13.08	.....	7.83	.....	5.55	5.7	.....	6.52	.....	8.5

NOTE.—River seldom freezes over at the gage, but there was considerable needle ice during January and February and part of December.

Rating table for Chenango River at Binghamton, N. Y., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.90	115	6.20	1,360	7.50	3,220	9.60	6,790
5.00	175	6.30	1,490	7.60	3,375	9.80	7,140
5.10	240	6.40	1,625	7.70	3,535	10.00	7,500
5.20	315	6.50	1,760	7.80	3,695	10.20	7,860
5.30	396	6.60	1,900	7.90	3,855	10.40	8,220
5.40	480	6.70	2,040	8.00	4,020	10.60	8,590
5.50	570	6.80	2,180	8.20	4,355	10.80	8,970
5.60	665	6.90	2,325	8.40	4,695	11.00	9,350
5.70	765	7.00	2,470	8.60	5,040	12.00	11,250
5.80	875	7.10	2,615	8.80	5,390	13.00	13,250
5.90	990	7.20	2,765	9.00	5,740	14.00	15,300
6.00	1,110	7.30	2,915	9.20	6,090		
6.10	1,235	7.40	3,065	9.40	6,440		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1901–1906. It is well defined between gage heights 5.3 feet and 10 feet, and is based on one high-water measurement above 10 feet.

Monthly discharge of Chenango River at Binghamton, N. Y., for 1906.

[Drainage area, 1,530 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	14,200	1,490	3,550	2.32	2.68
February	5,780	820	1,930	1.26	1.31
March	14,100	776	3,520	2.30	2.65
April	13,300	1,440	6,220	4.07	4.54
May	10,800	967	2,910	1.90	2.19
June	3,970	1,030	2,040	1.33	1.48
July	3,000	525	1,300	.850	.98
August	1,360	396	789	.516	.59
September	570	145	380	.248	.28
October	5,220	355	1,260	.824	.95
November	6,090	875	2,180	1.42	1.58
December	8,220	875	2,700	1.76	2.03
The year	14,200	145	2,400	1.57	21.26

NOTE.—Values for January, February, and December are probably slightly in excess of the true value owing to needle ice. Values for entire year are excellent except January, February, and December, which are good.

CHEMUNG RIVER AT CHEMUNG, N. Y.

This station was established September 7, 1903. It is located at the suspension highway bridge, midway between Chemung, N. Y., and Willawana, Pa., near the State line. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 35, where are given also references to publications that contain data for previous years.

Discharge measurements of Chemung River at Chemung, N. Y., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
March 21	F. H. Brundage	391	3,380	9.46	16,500
March 22	do	389	3,410	9.49	16,600
March 22	do	389	3,090	8.84	13,900
March 26	W. B. Freeman	393	4,460	12.10	29,300
March 26	do	393	4,190	11.39	25,900
May 18	H. R. Beebe	220	1,040	2.64	714
July 20	Murphy and Covert	216	1,060	2.62	748
August 23	Covert and Weeks	197	904	2.28	435
1906.					
February 17	Covert and Weeks	225	1,040	[a] 2.85	674
March 30	Horton and Mott	393	2,560	7.20	9,850
March 31	R. E. Horton	395	4,340	11.73	27,500
March 31	do	394	4,120	11.40	25,600
July 27	C. C. Covert	200	935	2.29	416
September 15	do	186	860	1.89	216
October 4	do	203	879	2.03	381

[a] Ice conditions; gage height to bottom of ice, 2.42 feet; average thickness of ice, .53 feet; considerable needle ice.

Daily gage height, in feet, of Chemung River at Chemung, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.27	3.4	2.52	7.42	3.15	4.44	3.34	2.28	2.19	1.55	3.46	3.33
2	3.93	3.16	2.56	6.54	3.09	4.15	3.42	2.24	2.04	1.73	3.31	2.86
3	3.54	3.24	2.57	5.93	3.28	3.73	5.2	2.2	2.14	1.89	3.25	2.87
4	3.70	3.36	8.6	6.23	3.99	3.48	4.15	2.18	2.16	1.77	3.27	2.6
5	4.44	3.24	5.2	7.3	3.75	3.35	3.57	3.29	2.08	1.95	3.2	2.35
6	4.0	2.94	3.96	7.92	3.8	5.25	3.28	3.05	2.14	1.74	3.06	3.32
7	3.52	2.8	3.64	6.8	3.65	5.06	3.03	2.96	2.12	1.8	2.89	6.26
8	2.97	2.84	3.4	5.92	3.35	4.12	2.85	3.68	.....	2.87	2.81	4.56
9	2.66	2.92	3.3	5.68	3.25	3.74	2.83	3.76	.....	2.58	2.77	3.56
10	2.74	2.84	3.14	8.32	3.63	3.58	2.74	3.28	.....	2.38	2.64	3.55
11	2.86	2.71	2.97	8.4	3.55	3.65	2.68	3.85	1.78	2.12	2.62	3.26
12	3.02	2.88	2.9	7.14	3.26	3.47	2.66	4.15	1.81	2.31	2.66	3.72
13	2.92	2.66	2.85	6.33	3.24	3.15	2.55	3.52	1.96	2.36	2.74	3.28
14	2.86	2.64	2.74	5.82	3.22	2.84	2.45	3.1	2.09	2.4	2.92	3.42
15	2.86	2.7	2.7	6.73	3.2	2.85	2.4	2.82	1.78	2.41	2.97	3.54
16	2.79	2.72	2.71	6.82	3.2	3.38	2.33	2.58	1.62	2.36	2.96	5.48
17	2.6	2.8	2.6	5.92	3.29	6.53	2.35	2.46	1.74	2.22	2.9	4.6
18	2.78	2.8	2.32	5.36	4.94	7.11	2.44	2.39	1.62	2.17	3.04	3.96
19	2.78	2.6	2.56	4.92	4.54	6.12	2.6	2.32	1.56	2.14	6.13	2.74
20	2.79	2.62	2.2	4.56	3.92	6.13	2.59	2.61	1.52	5.4	5.84	2.48
21	2.78	2.79	2.38	4.24	3.44	4.92	2.47	3.36	1.54	5.32	5.63	3.37
22	4.54	3.31	2.58	4.34	3.28	4.29	2.51	3.1	1.54	4.9	5.6	3.36
23	7.02	3.35	2.44	4.25	3.18	3.9	2.34	2.66	1.63	4.28	4.88	3.45
24	8.08	2.94	2.58	3.7	3.06	3.81	2.32	3.1	1.84	3.8	4.34	4.97
25	5.77	2.58	2.43	3.96	3.25	3.43	2.3	3.04	1.8	3.48	3.78	4.46
26	4.56	2.7	2.54	3.81	3.14	3.2	2.28	2.68	1.72	3.36	3.76	3.94
27	4.14	2.86	3.88	3.56	6.72	3.04	2.28	2.67	1.74	3.28	3.58	4.36
28	3.93	2.54	11.94	3.37	8.68	2.93	2.30	2.6	1.54	3.09	3.36	4.42
29	3.64	.....	7.25	3.29	6.9	3.5	2.59	2.69	1.53	3.16	3.26	4.32
30	3.51	.....	7.06	3.21	5.42	3.48	2.38	2.44	1.49	3.1	3.16	4.32
31	3.33	.....	11.09	.....	4.72	.....	2.31	2.2	.....	3.08	.....	5.82

NOTE.—Ice conditions as follows: Shore ice only in January; river frozen over February 2 and probably remained frozen until the latter part of the month; considerable anchor ice during the greater part of December; river frozen over December 25; ice went out December 31.

Rating table for Chemung River at Chemung, N. Y., for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	85	3.00	1,010	4.50	3,200	7.00	9,220
1.60	115	3.10	1,110	4.60	3,400	7.20	9,790
1.70	145	3.20	1,220	4.70	3,610	7.40	10,300
1.80	180	3.30	1,335	4.80	3,820	7.60	11,010
1.90	220	3.40	1,455	4.90	4,030	7.80	11,650
2.00	270	3.50	1,580	5.00	4,240	8.00	12,300
2.10	325	3.60	1,710	5.20	4,680	9.00	15,800
2.20	385	3.70	1,850	5.40	5,130	10.00	19,700
2.30	450	3.80	2,000	5.60	5,590	11.00	24,000
2.40	515	3.90	2,160	5.80	6,060	12.00	28,700
2.50	585	4.00	2,320	6.00	6,550	13.00	33,500
2.60	660	4.10	2,480	6.20	7,070	14.00	39,300
2.70	740	4.20	2,650	6.40	7,590		
2.80	825	4.30	2,830	6.60	8,130		
2.90	915	4.40	3,010	6.80	8,670		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-1906. It is well defined above gage height 1.9 feet.

Monthly discharge of Chemung River at Chemung, N. Y., for 1905-6.

[Drainage area, 2,440 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
January 1-15 [a]	5,920	615	2,050	0.840	0.47
March 19-31 [a]	39,800	8,130	22,600	9.26	4.48
April	6,420	1,580	3,280	1.34	1.50
May	1,430	385	728	.298	.34
June	22,000	298	2,960	1.21	1.35
July	4,280	337	1,040	.426	.49
August	2,400	220	622	.255	.29
September	757	204	390	.160	.18
October	1,010	200	491	.201	.23
November	2,350	314	579	.237	.26
December	9,360	630	2,900	1.19	1.37
1906.					
January	12,600	660	2,300	.943	1.09
February [b]	.....	.....	2,000	.820	.85
March	28,400	385	3,670	1.50	1.73
April	13,600	1,230	6,040	2.48	2.77
May	14,600	1,070	2,680	1.10	1.27
June	9,530	861	2,780	1.14	1.27
July	4,680	437	905	.371	.43
August	2,560	373	975	.400	.46
September	379	82	204	.084	.09
October	5,130	100	1,120	.459	.53
November	6,890	676	1,960	.803	.90
December [b]	7,230	482	2,090	.857	.99
The year	28,400	82	2,230	.913	12.38

[a] A comparison of these figures with those for the discharge of Susquehanna River at McCall Ferry indicates that the mean discharge at the station for the period in 1905 not included in the table was approximately as follows: January 16-31, about 1,700 second-feet; February, about 900 second-feet; March 1-18, about 2,500 second-feet.

[b] Estimates for frozen period of 1906 are based on discharge of Susquehanna River at Binghamton.

NOTE.—Values for 1905 and 1906 are excellent, except those for February, 1906, which are fair.

WEST BRANCH OF SUSQUEHANNA RIVER AT WILLIAMSPORT, PA.

This station at Williamsport was established March 1, 1895, by George D. Snyder, who was at that time city engineer, and daily gage heights have been recorded since that date. It is located at the Market Street Bridge. The conditions at this station and the bench marks are described in Water Supply Paper No. 167, page 37, where are given also references to publications that contain data for previous years.

The following discharge measurement was made June 30, 1906:

Width, 744 feet; area, 3,620 square feet; gage height, 1.27 feet; discharge, 2,360 second-feet.

Daily gage height, in feet, of West Branch of Susquehanna River at Williamsport, Pa., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.7	3.7	1.9	10.7	2.9	5.2	1.1	1.4	1.3	0.9	2.2	2.2
2	5.2	3.4	1.2	9.6	2.7	4.5	1.0	1.3	1.0	.8	2.2	2.1
3	4.5	2.5	1.3	8.2	2.7	3.9	1.1	1.1	1.3	.9	2.3	2.1
4	4.3	2.3	4.4	7.6	2.8	3.4	1.1	1.9	2.7	1.0	2.1	1.9
5	5.4	2.5	5.3	7.6	2.9	2.9	1.1	2.2	2.5	.9	2.1	1.7
6	6.3	2.6	4.0	8.5	3.1	2.7	1.1	1.8	2.5	1.2	2.1	1.8
7	5.3	2.0	3.4	8.5	2.8	2.8	.9	1.7	2.1	1.4	1.9	2.5
8	4.6	1.9	3.1	7.5	2.6	2.6	.8	1.7	1.6	1.4	1.8	5.2
9	3.7	2.0	2.7	6.4	2.4	2.3	.8	1.7	1.2	1.4	1.9	4.8
10	3.7	2.2	2.8	7.7	2.4	2.1	.7	2.7	1.1	1.5	1.7	4.2
11	3.4	2.1	2.5	10.8	2.5	2.1	.6	3.9	.8	1.3	1.6	3.9
12	2.7	1.9	2.4	10.1	2.5	2.1	.4	5.7	.7	1.3	1.7	4.1
13	3.3	1.8	2.2	8.5	2.4	1.9	.5	4.6	1.0	1.4	1.7	3.9
14	3.2	1.9	2.1	7.3	2.3	1.7	.5	3.8	.9	1.2	1.7	3.8
15	3.1	2.3	2.1	7.2	2.2	1.5	.6	3.0	1.0	1.2	1.7	3.7
16	2.9	2.2	1.9	8.0	2.2	1.4	.4	2.4	1.0	1.2	1.6	3.5
17	2.9	1.6	1.9	7.4	2.1	2.0	.4	2.2	.9	1.1	1.6	4.1
18	3.1	1.4	1.8	6.5	2.8	2.0	3.5	1.7	.9	1.0	1.6	4.1
19	3.2	1.4	1.7	5.8	2.7	3.0	2.5	1.4	1.0	1.1	2.3	3.6
20	3.4	1.6	1.6	5.2	2.4	3.6	2.3	1.4	.8	2.1	3.1	3.0
21	3.9	1.5	1.3	4.9	2.2	3.1	2.3	1.7	.8	5.7	3.5	3.2
22	3.8	1.7	1.5	4.5	2.0	2.9	1.9	1.9	.9	5.2	3.7	3.4
23	5.6	1.9	1.7	4.3	1.8	2.2	1.7	2.4	1.0	4.3	3.9	3.3
24	11.4	1.8	1.6	4.3	1.7	1.9	1.7	2.2	1.1	3.6	3.9	3.0
25	10.7	1.9	1.4	4.2	1.9	1.7	1.5	2.0	1.1	3.3	3.4	2.1
26	8.4	2.0	1.6	4.0	2.3	1.5	1.5	1.9	1.0	2.9	3.2	1.6
27	6.9	1.9	1.9	3.7	2.3	1.4	1.4	1.7	.9	2.6	3.1	1.8
28	6.1	1.2	4.3	3.4	7.7	1.3	1.2	2.2	.9	2.6	2.7	1.9
29	5.2	.....	8.9	3.2	8.3	1.2	1.2	2.0	.8	2.4	2.5	2.4
30	4.8	.....	7.7	3.1	7.3	1.2	1.6	1.8	.8	2.3	2.5	2.7
31	4.1	.....	8.4	.....	6.0	.....	1.5	1.5	.....	2.3	.....	2.9

Rating table for West Branch of Susquehanna River at Williamsport, Pa., for 1905-6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.40	1,120	1.70	3,460	3.00	6,580	5.60	16,250
0.50	1,280	1.80	3,660	3.20	7,170	5.80	17,150
0.60	1,440	1.90	3,860	3.40	7,780	6.00	18,060
0.70	1,610	2.00	4,070	3.60	8,400	6.20	18,980
0.80	1,780	2.10	4,300	3.80	9,030	6.40	19,940
0.90	1,960	2.20	4,530	4.00	9,690	6.60	20,900
1.00	2,140	2.30	4,770	4.20	10,400	6.80	21,900
1.10	2,320	2.40	5,010	4.40	11,150	7.00	22,900
1.20	2,510	2.50	5,250	4.60	11,940	8.00	28,000
1.30	2,700	2.60	5,500	4.80	12,750	9.00	33,460
1.40	2,890	2.70	5,760	5.00	13,600	10.00	39,180
1.50	3,080	2.80	6,020	5.20	14,470	11.00	45,400
1.60	3,270	2.90	6,300	5.40	15,350	12.00	52,400

NOTE.—The above table is applicable only for open-channel conditions. It is based on the discharge measurements made during 1901-1906. It is well defined between gage heights 1.4 feet and 16 feet.

Monthly discharge of West Branch of Susquehanna River at Williamsport, Pa., for 1906.

[Drainage area, 5,640 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	48,000	5,760	14,100	2.50	2.88
February	8,710	2,510	4,270	.757	.79
March	32,900	2,510	7,600	1.35	1.56
April	44,100	6,870	22,000	3.90	4.35
May	29,600	3,460	7,630	1.35	1.56
June	14,500	2,510	5,320	.943	1.05
July	8,090	1,120	2,700	.479	.55
August	16,700	2,320	4,900	.869	1.00
September	5,760	1,610	2,530	.449	.50
October	16,700	1,780	4,540	.805	.93
November	9,360	3,270	5,120	.908	1.01
December	14,500	3,270	7,020	1.24	1.43
The year	48,000	1,120	7,310	1.30	17.61

NOTE.—Values are rated as follows: January, March to June, November, and December are excellent; remainder of the year good.

The following table gives the horsepower (80 per cent efficiency) per foot of fall that may be developed at different rates of discharge, and shows the number of days on which the flow and the corresponding horsepower were respectively less than the amounts given in the columns for "discharge" and "horsepower."

Discharge and horsepower table for West Branch of Susquehanna River at Williamsport, Pa., from 1895 to 1906.

Discharge in second-feet.	Horsepower (80 per cent efficiency) per foot fall.	Number of days of deficient flow.											
		1895.[a]	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
440	40	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
495	45	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
550	50	17	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
660	60	28	.....	2	.....	3	.....	.....	.....	.....	.....	.....	.....
770	70	43	.....	5	.....	13	17	.....	.....	.....	.....	.....	.....
880	80	76	.....	8	.....	24	37	.....	5	.....	15	.....	.....
990	90	96	2	18	.....	47	46	.....	6	.....	32	.....	.....
1,100	100	96	2	18	.....	47	46	.....	6	.....	32	.....	.....
1,320	120	112	17	39	19	75	55	4	25	1	67	.....	5
1,540	140	118	27	47	30	89	63	18	30	4	86	.....	7
1,760	160	124	30	56	40	96	76	28	30	5	103	2	9
1,980	180	136	36	71	53	106	113	50	43	10	118	7	27
2,200	200	142	43	84	66	114	131	64	54	23	132	10	37
2,750	250	160	59	108	90	133	150	100	89	46	150	24	67
3,300	300	186	86	125	111	150	159	126	119	77	168	54	101
3,850	350	195	101	138	131	150	169	138	137	98	185	87	130
4,400	400	207	127	162	160	170	194	158	158	125	194	119	174

[a] March 1 to December 31, 1895.

NOTE.—During period covered by the above table the minimum flow was 410 second-feet, giving 37 horsepower per foot of fall for five days in 1905.

JUNIATA RIVER AT NEWPORT, PA.

This gaging station was established March 21, 1899, and discontinued July 14, 1906. Until the autumn of 1904 it was located on the covered wagon bridge 800 feet east of the public square at Newport, Pa. In the latter part of 1904 this bridge was removed and a steel structure erected on the same site. The conditions at this station and the bench marks are described in Water-Supply Paper No. 137, page 40, where are given also references to publications that contain data for previous years.

The following discharge measurement was made June 28, 1906:

Width, 534 feet; area, 1,190 square feet; gage height, 378 feet; discharge, 2,330 second-feet.

Daily gage height, in feet, of Juniata River at Newport, Pa., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	5.0	3.9	3.7	10.0	4.0	3.4	4.4
2	4.9	3.9	3.8	9.8	4.0	3.4	4.2
3	5.0	3.9	4.0	9.7	4.0	3.4	4.2
4	7.5	3.8	6.1	8.8	4.0	3.4	4.0
5	7.5	3.8	6.0	8.4	4.0	3.3	3.8
6	7.4	3.7	5.9	7.9	4.0	3.3	4.6
7	6.7	3.7	5.9	7.9	4.2	3.3	3.7
8	5.9	3.7	5.6	7.9	4.2	3.3	3.8
9	5.4	3.7	5.0	8.0	4.0	4.35	3.7
10	4.8	3.8	4.8	7.7	4.0	6.0	3.7
11	4.8	3.7	4.6	9,3	3.9	4.2	3.6
12	4.6	3.7	4.6	8.2	3.9	3.6	3.5
13	4.6	3.6	4.5	8.2	3.8	3.6	3.4
14	4.6	3.6	4.5	9.0	3.6	3.6	3.4
15	4.8	3.6	4.5	9,7	3.6	3.4	.....
16	5.0	3.6	4.5	9.4	3.6	3.4	.....
17	5.2	3.5	4.7	8.3	3.6	3.4	.....
18	5.2	3.5	4.6	6.6	3.5	4.0	.....
19	5.1	3.4	4.4	6.1	3.5	6.9	.....
20	5.0	3.4	4.4	5.6	3.5	6.7	.....
21	5.0	3.4	4.4	5.3	3.4	5.3	.....
22	5.0	3.4	4.3	5.0	3.4	4.7	.....
23	5.4	3.4	4.3	5.1	3.4	4.6	.....
24	7.0	3.4	4.5	5.2	3.4	4.4	.....
25	7.1	3.6	4.3	4.8	3.4	4.2	.....
26	6.8	3.6	4.2	4.6	3.4	4.2	.....
27	6.0	3.7	4.2	4.3	3.6	4.0	.....
28	5.6	3.7	6.6	4.2	4.2	3.8	.....
29	5.4	.....	10.0	4.1	4.3	3.8	.....
30	5.0	.....	9.0	4.1	4.0	3.7	.....
31	4.8	.....	11.0	.....	3.6	.....	.....

Rating table for Juniata River at Newport, Pa., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.30	1,580	4.50	4,400	5.70	7,930	7.80	15,200
3.40	1,790	4.60	4,670	5.80	8,250	8.00	15,980
3.50	2,000	4.70	4,950	5.90	8,570	8.20	16,740
3.60	2,210	4.80	5,230	6.00	8,890	8.40	17,520
3.70	2,430	4.90	5,520	6.20	9,540	8.60	18,320
3.80	2,650	5.00	5,810	6.40	10,200	8.80	19,120
3.90	2,880	5.10	6,100	6.60	10,880	9.00	19,940
4.00	3,120	5.20	6,400	6.80	11,560	10.00	24,140
4.10	3,360	5.30	6,700	7.00	12,260	11.00	28,540
4.20	3,610	5.40	7,000	7.20	12,970		
4.30	3,870	5.50	7,310	7.40	13,700		
4.40	4,130	5.60	7,620	7.60	14,440		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1899-1906. It is well defined between gage heights 2.8 feet and 6.2 feet. The table has been extended beyond these limits, being based on one measurement at 8.2 feet. The table is the same as that for 1904 up to gage height 4 feet.

Monthly discharge of Juniata River at Newport, Pa., for 1906.

[Drainage area, 3,480 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	14,100	4,670	7,600	2.18	2.51
February	2,880	1,790	2,290	.658	.69
March	28,500	2,430	7,020	2.02	2.33
April	24,100	3,360	13,100	3.76	4.20
May	3,870	1,790	2,620	.753	.87
June	11,900	1,580	3,560	1.02	1.14
July 1-14	4,670	1,790	2,820	.810	.42

NOTE.—Values for entire year are excellent.

The following tables give the horsepower (80 per cent efficiency) per foot of fall that may be developed at different rates of discharge, and shows the number of days on which the flow and the corresponding horsepower were respectively less than the amounts given in the columns for "discharge" and "horsepower."

Discharge and horsepower table for Juniata River at Newport, Pa., from 1899–1906.

Discharge in second-feet.	Horsepower (80 per cent efficiency per foot fall).	Number of days of deficient flow.							
		1899.[a]	1900.	1901.	1902.	1903.	1904.	1905.	1906.[b]
275	25	7	.....	.....	.....	.....	2	.....	.....
330	30	12	.....	.....	.....	.....	4	2	.....
385	35	12	.....	.....	.....	.....	4	2	.....
440	40	24	.....	.....	.....	.....	8	5	.....
495	45	24	.....	.....	.....	.....	8	5	.....
550	50	24	.....	.....	.....	.....	8	5	.....
660	60	36	39	.....	4	.....	18	10	.....
770	70	62	67	.....	20	.....	74	10	.....
880	80	62	67	.....	20	.....	89	10	.....
990	90	90	108	30	25	.....	94	11	.....
1,100	100	90	108	30	25	.....	94	11	.....
1,320	120	125	128	39	38	2	120	11	.....
1,540	140	136	141	50	64	11	136	24	.....
1,760	160	160	172	67	86	42	144	29	4
1,980	180	175	185	90	108	63	145	44	25
2,200	200	185	199	117	126	111	151	76	31
2,750	250	209	228	163	167	138	178	192	69

[a] March 21 to December 31. [b] January 1 to July 14.

NOTE.—From March 21, 1899, to July 14, 1906, the minimum flow was 230 second-feet, giving 21 horsepower per foot of fall, on 6 consecutive days in June, 1899, 1 day in July, 1899, November, 1903, and December, 1903.

BROAD CREEK AT MILL GREEN, MD.

This gaging station was established December 14, 1904. It is located in the village of Mill Green, on the steel highway bridge, and is best reached from Cardiff, Md. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 43.

Discharge measurements of Broad Creek at Mill Green, Md., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 23	Grover and Lyman	14.5	8.8	2.40	16.2
November 2	G. F. Harley	26	26	2.20	11.9
November 2	do	17	12.1	2.25	12.8
1906.					
March 17	Follansbee and Henshaw	31	38	2.48	27.0
March 30	F. F. Henshaw	29	41	2.63	34.9
April 10	do	32	51	2.96	61
April 10	do	32	51	2.92	55

Daily gage height, in feet, of Broad Creek at Mill Green, Md., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.38	2.42	2.45	2.52	2.54	2.36	2.25	2.22	2.25	2.12	2.36	2.23
2	2.4	2.45	2.45	2.49	2.54	2.35	2.25	3.21	2.22	2.12	2.34	2.24
3	2.5	2.55	3.2	2.51	2.53	2.34	2.25	3.3	2.2	2.14	2.3	2.25
4	3.08	2.48	2.55	2.5	2.5	2.31	2.4	2.3	2.2	2.52	2.3	2.24
5	2.55	2.45	2.5	2.52	2.5	2.3	2.37	2.23	2.2	2.39	2.3	2.24
6	2.45	2.55	2.48	2.5	2.49	2.3	2.3	2.23	2.2	2.21	2.3	2.42
7	2.42	2.48	2.5	2.5	2.5	2.3	2.28	2.22	2.18	2.2	2.29	2.36
8	2.38	2.45	2.48	2.49	2.5	2.3	2.25	2.24	2.18	2.2	2.26	2.25
9	2.32	2.65	2.48	3.7	2.49	2.46	2.25	2.24	2.18	2.24	2.26	2.25
10	2.38	2.55	2.45	2.97	2.46	2.34	2.25	2.23	2.18	2.24	2.25	2.26
11	2.4	2.5	2.48	2.67	2.45	2.31	2.25	2.23	2.18	2.21	2.32	2.39
12	2.7	2.45	2.45	2.62	2.46	2.3	2.24	2.22	2.18	2.14	2.32	2.28
13	2.4	2.65	2.45	2.6	2.44	2.3	2.23	2.2	2.17	2.12	2.3	2.25
14	2.45	3.62	2.52	2.61	2.42	2.3	2.2	2.2	2.16	2.12	2.3	2.25
15	2.52	2.62	2.5	3.98	2.4	2.3	2.2	2.2	2.15	2.13	2.3	2.25
16	2.55	2.45	2.58	2.72	2.4	2.38	2.38	2.2	2.15	2.12	2.34	2.26
17	2.42	2.42	2.45	2.67	2.4	2.48	2.52	2.19	2.15	2.14	2.34	3.38
18	2.35	2.38	2.48	2.59	2.4	2.49	2.44	2.18	2.15	2.15	2.51	2.54
19	2.38	2.45	2.52	2.6	2.4	2.56	2.26	2.18	2.15	2.85	2.66	2.32
20	2.32	2.42	2.52	2.6	2.39	2.39	2.25	2.21	2.15	3.42	2.39	3.22
21	2.38	2.48	2.56	2.58	2.35	3.1	2.24	2.2	2.15	2.64	2.35	2.68
22	2.42	2.45	2.5	2.61	2.35	2.69	2.38	2.21	2.15	2.39	2.35	2.32
23	2.45	2.42	2.54	2.64	2.36	2.36	2.34	2.2	2.15	2.35	2.34	2.3
24	2.5	2.45	2.52	2.6	2.35	2.35	2.24	3.55	2.15	2.34	2.3	2.3
25	2.48	2.52	2.48	2.59	2.35	2.34	2.22	2.6	2.14	2.6	2.29	2.29
26	2.45	2.48	2.56	2.56	2.35	2.31	2.21	2.3	2.12	2.35	2.28	2.26
27	2.42	2.45	3.68	2.55	2.35	2.3	2.34	2.26	2.12	2.35	2.27	2.25
28	2.52	2.48	2.72	2.54	2.4	2.29	2.24	2.36	2.12	2.32	2.25	2.25
29	2.45	.....	2.59	2.55	2.36	2.26	2.46	2.44	2.13	2.3	2.24	2.29
30	2.45	.....	2.64	2.55	2.35	2.25	2.28	2.32	2.12	2.3	2.23	2.36
31	2.48	.....	2.76	.....	2.44	.....	2.22	2.28	.....	2.39	.....	3.2

Rating table for Broad Creek at Mill Green, Md., for 1904–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	6	2.70	39	3.40	105	4.10	199
2.10	8	2.80	47	3.50	117	4.20	214
2.20	11	2.90	55	3.60	129	4.30	230
2.30	15	3.00	64	3.70	142	4.40	246
2.40	20	3.10	74	3.80	155	4.50	262
2.50	26	3.20	84	3.90	169	4.60	278
2.60	32	3.30	94	4.00	184	4.70	294

NOTE.—The above table is applicable only for open-channel conditions. It is based on 6 discharge measurements made during 1905–6. It is well defined between gage heights 2.2 feet and 3.3 feet.

Monthly discharge of Broad Creek at Mill Green, Md., for 1904–6.

[Drainage area, 16.4 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1904.					
December 14–31	76	.....	15.0	0.915	0.61
1905.					
January	184	.....	31.7	1.93	2.22
February	60	.....	14.2	.866	.90
March	187	29	54.2	3.30	3.80
April	64	26	33.7	2.05	2.29
May	84	16	23.6	1.44	1.66
June	86	13	19.8	1.21	1.35
July	246	11	29.3	1.79	2.06
August	286	11	29.7	1.81	2.09
September	49	13	16.1	.982	1.10
October	111	8	16.0	.976	1.13
November	45	9	13.0	.793	.88
December	184	11	26.1	1.59	1.83
The year	286	.....	25.6	1.56	21.31
1906.					
January	72	16	24.3	1.48	1.71
February	132	19	28.9	1.77	1.84
March	139	23	33.0	2.01	2.32
April	181	25	40.3	2.46	2.74
May	28	18	21.8	1.33	1.53
June	74	13	20.1	1.23	1.37
July	27	11	15.0	.915	1.05
August	123	10	21.8	1.33	1.53
September	13	9	9.9	.605	.67
October	107	9	19.0	1.16	1.34
November	36	12	16.4	1.00	1.12
December	103	12	23.1	1.41	1.63
The year	181	9	22.8	1.39	18.85

NOTE.—Flow during ice periods was determined by comparison with flow at other eastern Maryland gaging stations. Values are rated as follows: December, 1904, approximate, owing to ice conditions December 14–26; January and February, 1905, fair, owing to ice conditions January 25 to February 23; all others, 1905 and 1906, excellent; daily discharge above 180 second-feet, fair.

DEER CREEK NEAR CHURCHVILLE, MD.

This station was established December 14, 1904. It is located at the highway bridge on the Deer Creek road about 3 miles north of Churchville, and is best reached by driving from Belair. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 44, where are given also references to publications that contain data for previous years.

Discharge measurements of Deer Creek near Churchville, Md., 1904–1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1904.					
November 8	N. C. Grover	70	86	1.48	73
1905.					
June 23	Grover and Lyman	89	170	2.05	208
November 2	G. F. Harley	89	150	1.81	119
1906.					
March 17	Follansbee and Henshaw	91	185	2.20	233
March 30	F. F. Henshaw	91	219	2.54	380
April 10	do	92	282	3.11	696

Daily gage height, in feet, of Deer Creek near Churchville, Md., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.0	2.0	2.05	2.32	2.22	2.0	1.75	1.9	1.8	1.6	1.9	1.7
2	1.9	1.9	2.05	2.28	2.2	1.95	1.8	1.95	1.75	1.6	1.95	1.75
3	1.95	1.8	2.9	2.2	2.2	1.92	1.78	1.9	1.7	1.6	1.92	1.72
4	3.25	2.0	3.4	2.22	2.18	1.9	3.1	1.92	1.7	1.82	1.92	1.72
5	2.28	1.95	2.55	2.2	2.15	1.9	1.95	1.75	1.7	2.5	1.9	1.7
6	2.2	1.98	2.38	2.2	2.25	1.9	1.92	1.85	1.7	1.95	1.9	2.2
7	2.1	2.08	2.22	2.15	2.28	1.9	1.9	1.85	1.7	1.85	1.8	1.9
8	2.1	1.92	2.32	3.7	2.22	1.9	1.9	1.85	1.7	1.75	1.75	1.85
9	2.02	2.5	2.25	3.65	2.18	1.9	1.82	1.95	1.7	1.7	1.75	1.8
10	2.02	2.35	2.1	2.72	2.18	2.35	1.82	1.9	1.7	1.7	1.75	1.8
11	2.15	1.98	2.15	2.65	2.12	2.55	1.8	1.9	1.7	1.7	1.75	2.2
12	2.32	2.08	2.12	2.45	2.1	1.98	1.82	1.8	1.7	1.7	1.75	1.9
13	2.25	2.32	2.0	2.45	2.05	1.9	1.82	1.8	1.7	1.7	1.75	1.8
14	2.25	2.15	2.15	2.45	2.05	1.9	1.8	1.85	1.7	1.7	1.75	1.75
15	2.15	2.55	2.4	5.0	2.05	1.9	1.82	1.8	1.7	1.7	1.75	1.8
16	3.3	2.15	2.22	2.8	2.05	2.2	1.8	1.8	1.68	1.65	1.75	1.85
17	2.18	2.02	2.2	2.75	2.0	1.95	2.3	1.72	1.65	1.65	1.75	3.2
18	2.12	2.22	2.1	2.55	2.0	2.9	1.95	1.75	1.6	1.65	1.7	2.45
19	2.1	2.08	2.12	2.45	2.0	2.2	1.85	1.75	1.6	1.82	2.6	1.9
20	1.95	2.08	2.25	2.45	2.0	2.02	2.3	1.8	1.6	3.25	1.88	3.3
21	2.05	2.22	2.15	2.4	2.0	1.95	2.78	4.35	1.7	2.58	1.8	2.58
22	2.05	2.32	2.18	2.4	2.0	3.2	2.75	1.95	1.68	2.2	1.75	2.35
23	2.08	2.12	2.18	2.4	2.0	2.18	2.72	1.8	1.65	1.9	1.75	2.1
24	2.28	2.12	2.1	2.35	2.0	2.3	2.2	1.78	1.6	1.9	1.72	2.0
25	2.92	2.22	2.12	2.3	2.0	1.92	1.9	1.9	1.6	1.9	1.7	2.12
26	2.0	2.2	2.2	2.3	2.0	1.9	2.0	1.9	1.6	1.95	1.7	2.05
27	2.0	2.15	2.92	2.3	2.0	1.9	2.0	2.0	1.6	1.95	1.7	2.0
28	2.35	1.88	2.82	2.3	2.3	1.9	3.2	1.9	1.6	1.95	1.7	2.0
29	2.12	.....	2.5	2.28	2.3	1.88	3.45	1.9	1.6	1.9	1.7	2.0
30	2.95	.....	2.52	2.25	2.1	1.8	2.4	1.95	1.6	1.9	1.7	1.9
31	2.05	.....	2.52	.....	2.0	.....	1.9	1.85	.....	1.9	.....	3.8

NOTE.—There was considerable slush ice February 3–16, but the figures obtained from the rating table are probably not more than 10 per cent larger than the true values.

Rating table for Deer Creek near Churchville, Md., for 1904–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	72	2.70	445	3.90	1,210	5.10	2,280
1.60	87	2.80	495	4.00	1,290	5.20	2,380
1.70	105	2.90	550	4.10	1,370	5.30	2,485
1.80	126	3.00	605	4.20	1,450	5.40	2,590
1.90	150	3.10	665	4.30	1,535	5.50	2,700
2.00	178	3.20	725	4.40	1,620	5.60	2,810
2.10	209	3.30	790	4.50	1,710	5.70	2,920
2.20	242	3.40	855	4.60	1,800	5.80	3,030
2.30	277	3.50	920	4.70	1,890	5.90	3,140
2.40	315	3.60	990	4.80	1,985	6.00	3,260
2.50	355	3.70	1,060	4.90	2,080		
2.60	400	3.80	1,135	5.00	2,180		

NOTE.—The above table is applicable only for open-channel conditions. It is based on six discharge measurements made during 1904–1906. It is well defined between gage heights 1.5 feet and 3.5 feet.

Monthly discharge of Deer Creek near Churchville, Md., for 1904–1906.

[Drainage area, 141 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1904.					
December 14–31	522	.....	130	0.922	0.62
1905.					
January	3,200	.....	264	1.87	2.16
February	695	.....	162	1.15	1.20
March	955	164	377	2.67	3.08
April	635	178	254	1.80	2.01
May	296	105	153	1.09	1.26
June	335	96	144	1.02	1.14
July	495	96	162	1.15	1.33
August	2,680	96	249	1.77	2.04
September	920	105	194	1.38	1.54
October	822	105	168	1.19	1.37
November	323	105	130	.922	1.03
December	2,230	115	265	1.88	2.17
The year	3,200	.....	210	1.49	20.33
1906.					
January	790	150	273	1.94	2.24
February	377	126	219	1.55	1.61
March	855	178	301	2.13	2.46
April	2,180	225	426	3.02	3.37
May	277	178	211	1.50	1.73
June	725	126	212	1.50	1.67
July	887	115	251	1.78	2.05
August	1,580	109	187	1.33	1.53
September	126	87	99.2	.704	.79
October	758	87	165	1.17	1.35
November	400	105	132	.936	1.04
December	1,140	105	243	1.72	1.98
The year	2,180	87	227	1.60	21.82

NOTE.—The flow during the frozen period of 1904 to 1905 was determined by intercomparison of flow at eastern Maryland stations. Discharge computations for 1906 were not corrected for ice conditions. Values are rated as follows: December, 1904, approximate, owing to ice conditions December 14 to 27; January and February, 1905, fair, owing to ice conditions January 27 to February 22; March, 1905, to December, 1906, excellent; daily discharge above 2,000 second-feet, fair.

GUNPOWDER RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The headwaters of Gunpowder River lie in York County, Pa., near the Maryland line. Thence the river flows southeastward through Baltimore County, Md., and empties into Chesapeake Bay about 10 miles northeast of Baltimore. The river, though small, has steep slopes, and the powers have considerable value on account of their proximity to a large city. A portion of the water supply for Baltimore is taken from this river at Loch Raven, and the city has purchased all the power rights below this place. Little Gunpowder Falls, which is tributary below the fall line, has the same general characteristics as the larger river. Throughout its entire length it forms the boundary between Harford and Baltimore counties, Md. There are several small power developments.

GUNPOWDER FALLS AT GLENCOE, MD.

This station was established December 15, 1904. It is located at a steel highway bridge near the Pennsylvania Railroad station at Glencoe. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 46.

Discharge measurements of Gunpowder Falls at Glencoe, Md., in 1905 and 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 22	Grover and Lyman	66	93	1.53	138
November 3	F. F. Henshaw	66	89	1.80	138
1906.					
March 31	F. F. Henshaw	74	211	2.99	439
April 9	do	76	269	3.80	722
April 9	do	76	314	4.27	978

Daily gage height, in feet, of Gunpowder Falls at Glencoe, Md., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.1	2.12	2.22	2.7	2.52	2.5	1.68	2.0	1.88	1.52	2.02	1.62
2	2.02	2.0	2.1	2.65	2.5	2.2	1.65	3.2	1.8	1.48	1.85	1.58
3	2.25	3.05	2.85	2.52	2.5	2.0	1.7	2.6	1.82	1.58	1.82	1.62
4	3.88	3.65	3.25	2.5	2.48	2.0	2.9	2.58	1.7	2.02	1.78	1.58
5	2.78	3.4	3.12	2.5	2.6	1.9	2.15	2.28	1.65	2.68	1.78	1.7
6	2.6	3.18	2.8	2.5	2.5	1.9	2.0	2.15	1.7	1.82	1.8	2.02
7	2.38	3.25	2.65	2.4	2.7	1.92	1.9	2.08	1.72	1.72	1.72	1.92
8	2.32	3.32	2.68	2.4	2.45	1.9	1.85	2.0	1.7	1.68	1.72	1.62
9	2.32	3.65	2.58	3.68	2.48	2.2	1.8	2.0	1.6	1.6	1.72	1.65
10	2.28	3.62	2.48	4.42	2.4	2.4	1.85	1.92	1.52	1.9	1.7	1.75
11	3.88	3.15	2.38	3.4	2.38	2.25	2.22	1.95	1.55	1.75	1.75	2.32
12	3.58	3.18	2.4	3.1	2.4	1.98	1.95	1.9	1.55	1.6	1.88	1.78
13	2.55	3.25	2.38	2.9	2.32	1.95	1.8	1.98	1.6	1.6	1.75	1.75
14	2.42	3.75	2.35	2.9	2.3	1.88	1.75	1.88	1.6	1.58	1.7	1.78
15	2.45	2.88	2.6	5.9	2.25	1.88	1.7	1.8	1.55	1.55	1.72	1.75
16	2.55	2.22	2.42	3.5	2.25	1.85	1.72	1.8	1.55	1.5	1.75	1.75
17	2.42	2.18	2.4	3.22	2.3	2.0	2.28	1.8	1.5	1.58	1.78	2.85
18	2.32	2.05	2.35	3.12	2.2	2.62	1.95	1.8	1.52	1.8	1.7	2.7
19	2.3	2.15	2.45	3.0	2.15	2.6	1.75	1.65	1.55	2.25	2.3	2.08
20	2.25	2.18	2.45	2.9	2.1	2.15	1.7	2.95	1.52	3.25	1.95	3.05
21	2.2	2.22	2.32	2.9	2.1	2.75	1.8	1.95	1.6	2.68	1.88	2.8
22	2.2	2.98	2.4	2.95	2.1	2.98	5.1	1.85	1.62	2.85	1.8	2.52
23	2.2	2.42	2.32	2.98	2.08	2.52	2.6	1.78	1.52	2.3	1.8	2.28
24	2.45	2.4	2.28	2.82	2.08	2.3	2.1	5.0	1.42	2.42	1.72	1.85
25	2.15	2.5	2.25	2.72	2.05	2.05	1.82	2.22	1.5	2.5	1.68	3.78
26	2.1	2.6	2.45	2.72	2.02	1.9	1.75	2.0	1.5	2.1	1.65	3.88
27	2.1	2.38	4.0	2.68	2.1	1.9	1.75	2.32	1.6	2.0	1.68	3.5
28	2.5	2.3	3.42	2.6	2.52	1.9	2.9	2.42	1.55	1.98	1.65	3.75
29	2.3	.....	2.98	2.55	2.4	1.8	3.4	2.28	1.55	1.9	1.6	3.32
30	2.12	.....	3.05	2.58	2.1	1.78	2.35	2.18	1.52	1.85	1.6	2.92
31	2.15	.....	3.02	.....	2.05	.....	2.08	1.95	.....	2.0	.....	3.05

NOTE.—Ice jam January 11-12, and February 3-5 and 13. River frozen over February 6-12. Ice jam December 24-30.

Rating tables for Gunpowder Falls at Glencoe, Md.

DECEMBER 15, 1904, TO AUGUST 25, 1905.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	100	2.40	335	3.50	730	4.00	1,240
1.40	114	2.50	365	3.60	770	4.70	1,295
1.50	130	2.60	395	3.70	810	4.80	1,350
1.60	147	2.70	430	3.80	855	4.90	1,405
1.70	166	2.80	465	3.90	900	5.00	1,460
1.80	186	2.90	500	4.00	945	6.00	2,070
1.90	207	3.00	535	4.10	990	7.00	2,740
2.00	230	3.10	570	4.20	1,040	8.00	3,440
2.10	254	3.20	610	4.30	1,090	9.00	4,160
2.20	280	3.30	650	4.40	1,140		
2.30	307	3.40	690	4.50	1,190		

[a] This table is applicable only for open-channel conditions. It is based on 1 discharge measurement made during 1905 and on the form of the 1905–6 curve.

AUGUST 26, 1905, TO DECEMBER 31, 1906.[b]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	77	2.80	375	4.20	910	5.60	1,650
1.50	90	2.90	407	4.30	955	5.70	1,710
1.60	104	3.00	440	4.40	1,000	5.80	1,770
1.70	119	3.10	475	4.50	1,050	5.90	1,835
1.80	135	3.20	510	4.60	1,100	6.00	1,900
1.90	152	3.30	545	4.70	1,150	6.10	1,965
2.00	170	3.40	580	4.80	1,200	6.20	2,030
2.10	190	3.50	620	4.90	1,255	6.30	2,095
2.20	212	3.60	660	5.00	1,310	6.40	2,160
2.30	235	3.70	700	5.10	1,365	6.50	2,230
2.40	260	3.80	740	5.20	1,420	6.60	2,300
2.50	286	3.90	780	5.30	1,475		
2.60	314	4.00	820	5.40	1,530		
2.70	344	4.10	865	5.50	1,590		

[b] This table is applicable only for open-channel conditions. It is based on 4 discharge measurements made during 1905 and 1906. It is fairly well defined between gage heights 1.8 feet and 5 feet.

NOTE.—At times of measurements the error in discharge determinations may be less than 5 per cent, at other times it may be as much as 25 per cent at low stages, and 10–15 per cent at high stages for short periods.

Monthly discharge of Gunpowder Falls at Glencoe, Md., for 1904–1906.

[Drainage area, 160 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1904.					
December 15–31	.....	.....	150	0.938	0.59
1905.					
January	3,510	.....	311	1.94	2.24
February	.....	.....	150	.938	.98
March	1,140	.....	463	2.89	3.33
April	810	203	298	1.86	2.08
May	242	114	172	1.08	1.24
June	602	114	192	1.20	1.34
July	670	111	240	1.50	1.73
August	3,940	147	361	2.26	2.61
September	820	107	218	1.36	1.52
October	1,270	93	211	1.32	1.52
November	503	111	147	.919	1.03
December	2,260	143	310	1.94	2.24
The year	3,940	93	256	1.60	21.86

Monthly discharge of Gunpowder Falls at Glencoe, Md., for 1904–1906—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1906.					
January	772	174	255	1.59	1.83
February	720	170	268	1.68	1.75
March	820	190	330	2.06	2.38
April	1,840	260	461	2.88	3.21
May	344	174	239	1.49	1.72
June	433	132	205	1.28	1.43
July	1,360	111	227	1.42	1.64
August	1,310	111	237	1.48	1.71
September	149	80	104	.650	.72
October	527	86	179	1.12	1.29
November	235	104	132	.825	.92
December	457	101	203	1.27	1.46
The year	1,840	80	237	1.48	20.06

NOTE.—The discharge during the frozen periods was determined by intercomparison of data collected at eastern Maryland gaging stations.

Values for December, 1904, are approximate, owing to ice conditions. Values for January to August, 1905, are fair. Values from September, 1905, to December, 1906, are good. Ice conditions, December, 1904, January 1–6, and January 15 to March 4, 1905. For 1906 ice conditions see footnote to gage heights.

LITTLE GUNPOWDER FALLS NEAR BELAIR, MD.

This station was established December 13, 1904. It is located at a steel highway bridge on the road from Belair to Kingsville, at a distance of about 5 miles from Belair, from which place it is best reached by driving. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 48, where are given also references to publications that contain data for previous years.

Discharge measurements of Little Gunpowder Falls near Belair, Md., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 22	Grover and Lyman	33	32	1.50	49.9
November 1	G. F. Harley	38	47	1.39	44.5
1906.					
March 16	Follansbee and Henshaw	39	69	1.95	91
March 31	F. F. Henshaw	39	71	1.98	101
April 11	do	40	73	2.09	127

Daily gage height, in feet, of Little Gunpowder Falls near Belair, Md., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.52	1.68	1.78	1.86	1.84	2.09	1.54	1.56	1.56	1.47	1.71	1.56
2	1.55	1.58	1.62	1.76	1.88	1.78	1.55	2.16	1.58	1.45	1.56	1.54
3	1.6	1.75	2.18	1.76	1.88	1.69	1.49	2.08	1.59	1.44	1.56	1.58
4	2.55	1.85	2.52	1.82	1.83	1.66	2.04	1.66	1.54	1.92	1.59	1.49
5	1.82	1.65	1.88	1.75	1.94	1.68	1.64	1.6	1.5	2.32	1.58	1.54
6	1.72	1.9	1.75	1.84	2.0	1.68	1.52	1.52	1.46	1.66	1.56	1.92
7	1.6	1.92	1.8	1.81	1.89	1.62	1.58	1.6	1.4	1.59	1.53	1.71
8	1.68	2.0	1.78	1.76	1.86	1.7	1.53	1.38	1.48	1.52	1.52	1.66
9	1.62	2.3	1.78	3.18	1.85	1.64	1.43	1.5	1.5	1.48	1.55	1.59
10	1.85	2.02	1.75	2.9	1.79	1.95	1.52	1.49	1.5	1.68	1.58	1.64
11	1.9	1.85	1.7	2.04	1.84	1.88	1.45	1.46	1.46	1.5	1.7	1.82
12	2.1	1.82	1.7	1.94	1.81	1.6	1.53	1.49	1.53	1.43	1.64	1.6
13	1.85	2.1	1.7	1.86	1.79	1.66	1.54	1.85	1.5	1.58	1.57	1.65
14	1.88	2.48	1.68	1.88	1.78	1.62	1.5	1.62	1.49	1.49	1.6	1.65
15	1.8	2.2	2.05	4.18	1.79	1.63	1.49	1.52	1.42	1.45	1.62	1.56

Daily gage height, in feet, of Little Gunpowder Falls near Belair, Md., for 1906—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	1.88	1.78	1.9	2.24	1.8	1.68	1.49	1.46	1.46	1.48	1.63	1.62
17	1.78	1.75	1.85	2.09	1.72	1.65	2.22	1.45	1.48	1.46	1.6	2.42
18	1.68	1.75	1.82	2.02	1.78	2.42	1.64	1.42	1.46	1.46	1.58	1.98
19	1.7	1.68	1.88	1.95	1.72	2.05	1.58	1.5	1.44	1.99	2.52	1.75
20	1.65	1.65	1.88	1.95	1.7	1.79	1.46	3.34	1.42	2.5	1.88	2.7
21	1.65	1.68	1.85	1.95	1.66	1.72	1.52	2.06	1.62	2.39	1.76	2.09
22	1.58	1.95	1.85	1.94	1.64	2.0	2.42	2.8	1.42	1.84	1.72	1.94
23	1.65	1.68	1.88	1.92	1.69	1.71	1.68	1.75	1.46	1.65	1.65	1.82
24	1.92	1.75	1.8	1.92	1.64	1.82	1.51	1.62	1.46	1.65	1.64	1.82
25	1.62	1.78	1.78	1.88	1.69	1.64	1.48	1.85	1.4	2.26	1.61	2.56
26	1.62	1.68	1.95	1.89	1.72	1.56	1.4	1.74	1.36	1.72	1.67	2.56
27	1.58	1.7	2.62	1.89	1.73	1.62	1.52	1.96	1.46	1.64	1.61	1.76
28	1.85	1.75	2.18	1.86	1.9	1.56	1.48	2.06	1.46	1.64	1.62	1.7
29	1.65	.....	1.92	1.86	1.88	1.56	2.19	2.08	1.36	1.55	1.5	1.8
30	1.68	.....	1.9	1.9	1.74	1.54	1.69	1.8	1.42	1.53	1.59	1.71
31	1.65	.....	1.95	.....	2.49	.....	1.56	1.61	.....	1.66	.....	2.71

NOTE.—Probable backwater, December 25-26.

Rating table for Little Gunpowder Falls near Belair, Md., for 1904-1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	19	2.00	103	2.80	263	3.60	480
1.30	26	2.10	119	2.90	288	3.70	510
1.40	34	2.20	136	3.00	314	3.80	540
1.50	43	2.30	155	3.10	340	3.90	570
1.60	53	2.40	175	3.20	367	4.00	600
1.70	64	2.50	195	3.30	394	4.10	630
1.80	76	2.60	216	3.40	422	4.20	660
1.90	89	2.70	239	3.50	450		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 6 discharge measurements made during 1904-1906. It is well defined between gage heights 1.4 feet and 2.2 feet. At times of measurements the error in discharge determinations may be less than 5 per cent, but at other times it may be 10 to 15 per cent, owing to shifting of channel.

Monthly discharge of Little Gunpowder Falls near Belair, Md., for 1904-1906.

[Drainage area, 43 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1904.					
December 13-31	.....	.....	40.0	0.930	0.66
1905.					
January	486	.....	75.5	1.76	2.03
February	175	.....	50.2	1.17	1.22
March	416	74	127	2.95	3.40
April	195	62	80.5	1.87	2.09
May	89	41	58.9	1.37	1.58
June	171	30	55.1	1.28	1.43
July	444	32	80.0	1.86	2.14
August	136	25	41.6	.967	1.11
September	165	32	44.6	1.04	1.16
October	116	26	44.0	1.02	1.18
November	136	20	42.2	.981	1.09
December	630	26	74.7	1.74	2.01
The year	630	20	64.5	1.50	20.44

Monthly discharge of Little Gunpowder Falls near Belair, Md., for 1904-1906—Cont'd.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1906.					
January	205	45	71.7	1.67	1.92
February	191	51	84.6	1.97	2.05
March	221	55	91.1	2.12	2.44
April	654	70	124	2.88	3.21
May	193	57	79.3	1.84	2.12
June	179	47	70.8	1.65	1.84
July	179	34	58.4	1.36	1.57
August	405	32	82.4	1.92	2.21
September	55	31	39.4	.916	1.02
October	195	37	67.9	1.58	1.82
November	199	43	60.0	1.40	1.56
December	241	42	83.5	1.94	2.24
The year	654	31	76.1	1.77	24.00

NOTE.—The discharge during the frozen period was determined by intercomparison of data collected at eastern Maryland gaging stations.

Values for December, 1904, are approximate, owing to ice conditions. Values for 1905 and 1906 are fair, except those for March and April, 1906, which are good. Ice conditions December, 1904, January 1 to 6 and January 26 to February 25, 1905, and December 25 and 26, 1906.

PATAPSCO RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Patapsco River is formed by the junction of North Branch and South or Piney Branch near Marriottsville, Md., and flows in a southeasterly direction into Chesapeake Bay, 13 miles south of Baltimore. Both branches rise in the central part of Maryland, and the whole basin, which has an area of about 350 square miles, lies within that State.

The drainage basin is hilly and largely under cultivation. It has no lakes or artificial reservoirs, and the flow of the stream is variable. The maximum estimated flow at the gaging station at Woodstock, Md., where the drainage area is 251 square miles, is about 12,000 second-feet, while the minimum estimated flow has been about 50 second-feet. The record from which these estimates have been taken extends over a period of nine and one-half years. The freshets do not, however, cause very large rises of the water because of the steep slope of the stream. The maximum recorded difference in gage height at Woodstock is 13 feet, while the usual range within a year is about 3 or 4 feet.

The bed is generally rock. The banks are of rock and very little land is subject to overflow. The Baltimore and Ohio Railroad follows the stream closely throughout nearly its entire length.

The river carries a small volume of water, but as it has considerable slope a large number of water powers have been developed along its course. These, though small, are made valuable by their proximity to Baltimore.

PATAPSCO RIVER AT WOODSTOCK, MD.

This station was established August 6, 1896. It is located near the railroad station at Woodstock, 1.5 miles below the mouth of the North Branch. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 49, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Patapsco River at Woodstock, Md., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.2	4.2	4.15	4.6	4.35	4.05	4.0	5.9	4.25	4.1	3.9	4.0
2	4.1	4.2	4.2	4.5	4.4	4.0	3.9	12.5	4.3	3.95	3.95	4.05
3	4.2	4.05	5.7	4.4	4.45	3.85	3.95	6.9	4.25	3.85	3.8	4.15
4	5.75	4.15	6.6	4.35	4.35	3.9	6.55	4.75	4.15	4.15	3.95	4.1
5	4.65	4.2	4.75	4.35	4.8	3.95	4.6	4.3	4.15	5.05	3.9	3.95
6	4.45	4.85	4.55	4.35	4.35	3.9	4.1	4.35	4.05	4.5	4.0	4.15
7	4.3	4.6	4.45	4.3	4.35	3.85	3.9	4.15	4.15	4.3	4.0	4.0
8	4.3	4.3	4.5	4.35	4.4	3.85	3.9	4.2	4.0	4.15	3.9	4.1
9	4.2	4.85	4.4	4.55	4.3	3.95	4.05	4.1	4.0	4.0	3.85	4.15
10	4.15	4.35	4.3	4.45	4.25	3.9	4.1	4.05	4.1	4.2	4.0	4.15
11	4.2	4.05	4.25	4.35	4.25	4.3	4.0	4.2	4.05	4.05	4.0	4.45
12	4.5	4.1	4.2	4.4	4.3	4.15	4.0	4.45	3.95	3.9	3.95	4.15
13	4.4	4.25	4.2	4.45	4.25	4.05	3.95	4.55	4.0	3.8	3.9	4.15
14	4.4	4.55	4.3	4.35	4.15	3.95	3.85	4.05	3.9	3.85	3.85	4.05
15	4.45	4.6	4.9	9.45	4.15	3.9	3.8	3.95	4.15	3.95	3.95	4.05
16	4.45	4.1	4.6	5.3	4.2	3.85	3.95	4.05	4.05	3.9	3.95	4.35
17	4.3	4.05	4.45	5.0	4.15	4.05	4.0	4.0	4.0	4.25	4.0	5.8
18	4.3	4.05	4.35	4.85	4.05	4.45	4.1	4.25	3.95	4.05	4.15	4.95
19	4.25	4.1	4.35	4.75	4.05	4.4	4.0	4.15	3.9	4.45	4.9	4.65
20	4.2	4.15	4.45	4.7	4.05	4.45	3.85	4.3	4.1	5.65	4.6	4.6
21	4.2	4.25	4.3	4.65	4.05	4.95	3.8	4.25	4.05	7.2	4.45	4.8
22	4.2	4.6	4.35	4.65	4.1	4.65	4.2	4.1	4.2	5.1	4.25	4.6
23	4.2	4.25	4.4	4.6	4.1	4.4	4.65	4.05	4.0	4.25	4.05	4.55
24	4.25	4.2	4.3	4.5	3.95	4.45	4.15	9.5	3.95	4.35	4.1	4.4
25	4.15	4.15	4.35	4.6	4.0	4.25	3.9	6.5	3.85	4.2	4.15	4.35
26	4.15	4.4	4.4	4.5	4.0	4.05	3.75	5.75	4.1	4.25	4.1	4.2
27	4.15	4.25	5.05	4.55	4.05	3.95	3.95	5.9	3.95	3.95	4.05	4.35
28	4.35	4.25	5.15	4.5	4.7	3.9	4.7	5.35	4.0	3.9	4.1	4.25
29	4.2	.....	4.75	4.45	4.3	3.9	4.4	4.65	3.9	3.85	4.15	4.2
30	4.15	.....	4.85	4.45	4.15	3.85	4.05	4.45	3.95	3.8	4.05	4.25
31	4.2	.....	4.85	.....	4.15	.....	3.95	4.4	.....	3.95	.....	5.4

Rating table for Patapsco River at Woodstock, Md., for 1904–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.20	36	4.20	332	5.20	1,026	7.00	2,778
3.30	50	4.30	383	5.30	1,115	7.50	3,273
3.40	66	4.40	438	5.40	1,206	8.00	3,772
3.50	86	4.50	497	5.50	1,300	8.50	4,278
3.60	111	4.60	561	5.60	1,396	9.00	4,788
3.70	139	4.70	629	5.70	1,493	10.00	5,818
3.80	170	4.80	701	5.80	1,591	11.00	6,858
3.90	204	4.90	777	5.90	1,689	12.00	7,908
4.00	242	5.00	857	6.00	1,788		
4.10	285	5.10	940	6.50	2,283		

NOTE.—The above table is applicable only for open-channel conditions. It is based on six discharge measurements made during 1904 and 1905. It is well defined.

Monthly discharge of Patapsco River at Woodstock, Md., for 1906.

[Drainage area, 251 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	1,540	285	410	1.63	1.88
February	739	264	388	1.55	1.61
March	2,380	308	596	2.37	2.73
April	5,250	383	692	2.76	3.08
May	701	223	355	1.41	1.63
June	817	187	303	1.21	1.35
July	2,330	155	341	1.36	1.57
August	8,440	204	1,020	4.08	4.70
September	383	187	264	1.05	1.17
October	2,980	170	446	1.78	2.05
November	777	170	281	1.12	1.25
December	1,590	223	452	1.80	2.08
The year	8,440	155	463	1.84	25.10

NOTE.—Values for entire year are excellent.

The following table gives the horsepower (80 per cent efficiency) per foot of fall that may be developed at different rates of discharge and shows the number of days on which the flow and the corresponding horsepower were respectively less than the amounts given in the columns for "discharge" and "horsepower:"

Discharge and horsepower table for Patapsco River at Woodstock, Md., from 1896 to 1906.

Discharge in second-feet.	Horsepower (80 per cent efficiency) per foot fall.	Number of days of deficient flow.										
		1896.[a]	1897.	1898.	1899.[b]	1900.[c]	1901.[d]	1902.	1903.	1904.	1905.	1906.
55	5	.....	.....	.....	.....	10	.....	.....	.....	2	.....	.....
66	6	1	1	1	.....	17	.....	.....	.....	12	.....	.....
88	8	6	7	8	3	24	1	.....	.....	77	.....	.....
110	10	22	18	18	5	34	6	1	.....	112	.....	.....
132	12	41	38	53	11	48	22	10	.....	161	9	.....
154	14	96	64	87	27	85	47	51	.....	184	26	.....
176	16	106	88	121	67	108	77	73	.....	222	92	6
198	18	120	101	127	89	120	93	82	2	241	114	19
220	20	126	116	151	134	134	127	110	6	257	145	40
275	25	133	158	202	175	178	179	174	44	325	220	120

[a] August 16 to December 31.
[b] February 1 to December 31.
[c] January 1 to November 30.
[d] Omitting September.

NOTE.—During the period covered by this table the minimum flow was 50 second-feet, giving 4.5 horsepower per foot of fall on two days in July, 1900, eight days in August, 1900, and one day each in June and September, 1904.

POTOMAC RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Potomac River is formed by the junction of its north and south branches, about 15 miles below Cumberland, Md., from which point it flows in a southeasterly direction into Chesapeake Bay. For its entire length it forms the southern boundary of the State of Maryland

and the northern boundary of the States of West Virginia and Virginia. It drains a total area of about 14,500 square miles.

North Branch of Potomac River rises in the Allegheny Mountains near the west corner of Maryland, and South Branch in the Alleghenies in Virginia and West Virginia. These branches, with their tributaries and the tributaries of the main stream as far down as the Shenandoah, drain a series of narrow and generally fertile valleys lying between the parallel ranges which make up the system of the Alleghenies in this region. Their slopes are not, as a rule, very great, and their beds are of gravel and sand. The slopes of their drainage basins are, however, usually very steep, and after a rain the water collects quickly in the rivers. There are few lowlands to be overflowed, and no lakes whatever in the region. Consequently these streams, and with them Potomac River, are subject to very sudden and heavy freshets in wet seasons, while in dry seasons their discharge becomes small. The record of gage height at Point of Rocks, Md., covering a period of nearly twelve years, shows a maximum range of 29 feet, and for several years the range has been more than 20 feet each year. The corresponding maximum and minimum discharges have been 219,000 and 900 second-feet, respectively.

The slopes of the tributary basin of Shenandoah River are in many instances steep, but the valley through which the Shenandoah flows is generally broader and more lands are subject to overflow. The slope of the river itself is usually greater than the slope of the tributaries above mentioned. As a result the fluctuations of this stream are not so great, having a maximum range of about 19 feet at Millville in twelve years, while the average annual fluctuation is 10 feet or less. The discharge in this period has ranged between 140,000 and 480 second-feet.

From the junction of its north and south branches below Cumberland, Md., the Potomac cuts through the mountains at nearly right angle. Its valley is narrow, its slope in many places great. The bed is generally gravel and bowlders, with ledge rock at small depth, which often appears at the surface. The banks are usually high and are not subject to overflow. It crosses the fall line a few miles above Washington and reaches tide water at Georgetown.

The Baltimore and Ohio Railroad follows the river for its entire length, and the Shenandoah Valley and the Cumberland Valley railroads cross the stream. The Chesapeake and Ohio Canal follows it from Cumberland to Georgetown.

As a water-power stream the principal disadvantage of the Potomac is the great variability of its flow. Good rock foundations for dams can generally be found at small depth, the banks are, as a rule, favorable, and there are several sites where large falls could be rendered available. A very insignificant amount of power has been developed.

The Great Falls of the Potomac, located about 15 miles above Washington (as shown in Pl. IV), offers one of the best undeveloped power sites along Potomac River.

The surface water resources of the Potomac River basin have been discussed in detail in Water-Supply Paper No. 192.

NORTH BRANCH OF POTOMAC RIVER AT PIEDMONT, W. VA.

This station was established June 27, 1899, and was discontinued July 15, 1906. It is located at the iron highway bridge connecting Luke, Md., with Piedmont, W. Va. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 53, and in Water-Supply Paper No. 192, where are given also the data for previous years.

Discharge measurements of North Branch of Potomac River at Piedmont, W. Va., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 16	Bolster and Padgett	146	243	3.51	412
March 30	Robert Follansbee	291	1,220	7.15	5,820
April 11	R. H. Bolster	284	787	5.64	2,590
May 28	Robert Follansbee	147	243	3.49	391

Daily gage height, in feet, of North Branch of Potomac River at Piedmont, W. Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	3.55	3.65	2.75	6.05	4.0	3.25	3.0
2	3.35	3.55	3.1	5.55	3.9	3.45	2.9
3	3.65	3.2	3.3	5.7	4.0	3.3	2.8
4	5.65	3.4	5.15	6.0	3.8	3.1	2.8
5	5.3	3.5	4.35	6.15	3.7	3.3	3.1
6	4.6	3.0	3.95	6.8	3.6	4.6	2.85
7	3.9	3.1	3.8	5.7	3.7	5.25	2.75
8	4.05	3.1	3.8	5.05	3.6	4.7	2.6
9	3.65	3.1	3.7	5.15	3.5	4.1	2.6
10	3.55	2.9	3.6	6.45	3.5	3.65	2.6
11	3.55	2.75	3.4	5.5	3.4	3.35	2.5
12	3.7	2.85	3.6	5.45	3.4	3.1	2.65
13	3.95	3.0	3.5	4.55	3.3	3.25	2.6
14	3.8	3.05	3.5	4.45	3.2	3.1	2.6
15	3.8	3.0	3.5	6.15	3.2	3.0	2.55
16	3.95	2.75	3.5	5.45	3.1	3.0	.....
17	4.15	2.8	3.4	4.85	3.1	2.9	.....
18	4.1	2.9	3.15	4.45	3.0	2.9	.....
19	4.7	2.8	3.4	4.25	3.0	2.9	.....
20	4.35	2.95	4.05	4.1	2.9	2.95	.....
21	4.5	3.0	3.8	3.95	2.9	3.1	.....
22	4.85	3.2	3.7	4.0	2.8	3.3	.....
23	8.2	3.1	3.7	4.0	2.8	3.2	.....
24	6.4	3.05	3.75	4.0	2.7	3.1	.....
25	5.1	3.1	3.55	4.1	2.7	3.0	.....
26	4.6	3.1	3.6	6.5	2.7	3.0	.....
27	4.35	3.05	5.05	5.4	2.7	3.6	.....
28	4.3	2.6	7.3	4.65	3.35	3.35	.....
29	4.15	.....	6.25	4.35	3.45	3.25	.....
30	3.95	.....	7.4	4.15	3.2	3.0	.....
31	3.8	.....	7.4	.....	3.0	.....	.....

NOTE.—Discharge probably unaffected by ice during 1906.

GREAT FALLS OF THE POTOMAC.

Rating table for North Branch of Potomac River at Piedmont, W. Va., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.50	70	3.70	519	4.90	1,655	6.20	3,450
2.60	88	3.80	587	5.00	1,770	6.40	3,785
2.70	109	3.90	661	5.10	1,890	6.60	4,140
2.80	133	4.00	740	5.20	2,015	6.80	4,515
2.90	160	4.10	825	5.30	2,140	7.00	4,900
3.00	190	4.20	915	5.40	2,270	7.20	5,300
3.10	224	4.30	1,010	5.50	2,400	7.40	5,710
3.20	262	4.40	1,110	5.60	2,535	7.60	6,130
3.30	304	4.50	1,215	5.70	2,675	7.80	6,570
3.40	350	4.60	1,320	5.80	2,820	8.00	7,030
3.50	401	4.70	1,430	5.90	2,970	8.20	7,500
3.60	457	4.80	1,540	6.00	3,125		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 3 discharge measurements made during 1906, and on the form of previous curves. It is well defined between gage heights 3.5 feet and 5.5 feet.

Monthly discharge of North Branch of Potomac River at Piedmont, W. Va., for 1906.

[Drainage area, 410 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	7,500	327	1,260	3.06	3.53
February	488	88	220	.537	.56
March	5,710	121	1,160	2.83	3.26
April	4,520	700	2,010	4.91	5.48
May	740	109	323	.788	.91
June	2,080	160	413	1.01	1.13
July 1-15	224	70	120	.293	.16

NOTE.—Values are rated as follows: January, February, and July, good; March to June, excellent.

POTOMAC RIVER AT POINT OF ROCKS, MD.

This station was established February 17, 1895. It is located at the steel highway bridge at Point of Rocks, Md. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 55, and in Water-Supply Paper No. 192, where are given also the data for previous years.

Discharge measurements of Potomac River at Point of Rocks, Md., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 30	Robert Follansbee	987	3,350	1.70	3,890
December 7 [a]	Bolster and Padgett	990	3,180	1.76	4,450

[a] Results not reliable, owing to heavy gale blowing downstream.

Daily gage height, in feet, of Potomac River at Point of Rocks, Md., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec
1	3.6	3.0	1.9	11.1	3.3	1.8	2.2	1.6	3.7	1.2	2.6	1.9
2	3.4	2.9	1.8	9.6	3.1	1.7	1.9	1.5	3.1	1.2	2.5	1.8
3	3.3	2.7	1.8	7.7	2.8	1.7	2.0	1.5	2.8	1.4	2.3	1.9
4	3.7	2.5	2.0	6.5	2.8	1.6	2.9	4.3	2.6	1.5	2.3	1.7
5	8.0	2.4	4.0	5.5	2.6	1.5	2.6	3.6	2.3	2.2	2.1	1.8
6	8.6	2.2	5.45	5.1	2.5	1.7	2.4	2.8	2.1	2.5	2.1	1.8
7	7.0	2.2	4.5	4.8	2.6	1.9	2.2	2.4	1.9	2.7	2.1	1.85
8	4.8	2.0	3.6	4.8	2.5	1.7	2.0	2.6	1.8	2.6	2.0	1.7
9	4.0	1.9	3.0	4.3	2.4	2.4	1.9	2.8	1.8	2.5	2.0	1.75
10	3.5	1.8	2.7	4.2	2.4	3.0	1.7	3.2	1.7	2.2	1.9	1.8
11	3.1	1.8	2.6	5.5	2.4	2.5	1.5	7.6	1.7	2.0	1.8	2.0
12	2.9	1.9	2.5	5.6	2.2	2.2	1.4	5.7	1.6	1.9	1.8	2.2
13	2.8	1.8	2.3	4.9	2.3	1.8	1.3	4.3	1.6	1.6	1.8	3.5
14	3.0	1.8	2.3	4.0	2.2	1.6	1.2	3.7	1.5	1.5	1.7	3.1
15	3.3	1.9	2.3	5.75	2.0	1.6	1.3	3.0	1.5	1.6	1.8	2.65
16	3.6	1.8	2.4	8.45	2.1	1.6	1.2	5.1	1.4	1.4	1.7	2.7
17	3.7	1.7	2.5	7.5	2.0	1.6	1.2	4.8	1.6	1.4	1.8	2.8
18	4.1	1.6	2.5	6.3	1.8	2.5	1.5	4.2	1.5	1.5	1.8	4.7
19	3.9	1.6	2.6	5.1	1.9	3.2	1.8	3.5	1.4	1.7	1.9	10.0
20	3.5	1.6	2.9	4.5	1.8	2.9	1.7	4.4	1.4	12.5	1.9	7.2
21	3.4	1.7	2.9	4.1	1.6	3.1	1.5	4.0	1.4	16.1	3.0	5.6
22	3.3	1.8	3.1	3.6	1.6	5.0	1.4	5.3	1.3	11.65	4.2	5.2
23	3.2	1.9	3.4	3.3	1.6	4.3	1.5	4.8	1.3	8.5	4.0	4.6
24	3.1	2.0	3.9	3.1	1.4	3.6	2.0	3.7	1.3	6.6	3.3	3.8
25	6.35	2.0	3.9	2.9	1.5	3.1	2.1	4.1	1.3	5.4	3.0	3.2
26	5.1	1.9	3.9	2.9	1.4	2.6	1.9	4.8	1.3	4.5	2.7	2.8
27	4.2	1.8	3.7	2.8	1.3	2.4	1.7	4.6	1.2	4.1	2.6	2.85
28	3.6	2.0	7.8	5.1	1.9	2.3	1.8	6.7	1.2	3.6	2.2	2.9
29	3.4	.....	12.9	5.0	1.9	3.1	1.9	6.0	1.2	3.3	2.1	3.0
30	3.2	.....	10.5	4.3	1.7	3.0	2.0	5.3	1.2	3.1	2.1	3.1
31	3.1	.....	10.9	.....	1.7	.....	1.7	4.4	.....	2.8	.....	3.2

NOTE.—Practically no ice conditions.

Rating table for Potomac River at Point of Rocks, Md., for 1902–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	2,530	2.60	7,330	4.00	14,070	6.80	31,460
1.30	2,810	2.70	7,750	4.20	15,150	7.00	32,820
1.40	3,100	2.80	8,180	4.40	16,270	8.00	39,980
1.50	3,400	2.90	8,620	4.60	17,430	9.00	47,600
1.60	3,700	3.00	9,070	4.80	18,610	10.00	55,600
1.70	4,010	3.10	9,530	5.00	19,820	11.00	63,900
1.80	4,330	3.20	10,000	5.20	21,060	12.00	72,200
1.90	4,670	3.30	10,480	5.40	22,300	13.00	80,500
2.00	5,020	3.40	10,970	5.60	23,560	14.00	88,800
2.10	5,380	3.50	11,470	5.80	24,840	15.00	97,100
2.20	5,750	3.60	11,980	6.00	26,140	16.00	105,400
2.30	6,130	3.70	12,490	6.20	27,460	17.00	113,700
2.40	6,520	3.80	13,010	6.40	28,780		
2.50	6,920	3.90	13,530	6.60	30,100		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1902–1906, inclusive. It is well defined between gage heights 1 foot and 14 feet. Above gage height 10 feet the rating curve is a tangent, the difference being 830 per tenth. The above table supersedes previous tables, from April 1, 1902, to December 31, 1906.

Monthly discharge of Potomac River at Point of Rocks, Md., for 1906.

[Drainage area, 9,650 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	44,500	8,180	15,000	1.55	1.79
February	9,070	3,700	5,120	.530	.55
March	79,700	4,330	15,900	1.65	1.90
April	64,700	8,180	22,400	2.33	2.60
May	10,500	2,810	5,540	.574	.66
June	19,800	3,400	7,010	.726	.81
July	8,620	2,530	4,380	.454	.52
August	37,100	3,400	15,200	1.58	1.82
September	12,500	2,530	4,280	.444	.50
October	106,000	2,530	16,300	1.69	1.95
November	15,200	4,010	6,340	.657	.73
December	55,600	4,010	11,000	1.14	1.31
The year	106,000	2,530	10,700	1.11	15.14

NOTE.—Values for entire year are excellent.

The following table gives the horsepower (80 per cent efficiency) per foot of fall that may be developed at different rates of discharge, and shows the number of days on which the flow and the corresponding horsepower were, respectively, less than the amounts given in the columns for "discharge" and "horsepower."

Discharge and horsepower table for Potomac River at Point of Rocks, Md., from 1895 to 1906.

Discharge in second-feet.	Horsepower (80 per cent efficiency), per foot fall.	Number of days of deficient flow.											
		1895.[a]	1896.[b]	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
990	90	.....	.....	.....	.....	.....	.....	.....	.....	.....	6	.....	.....
1,100	100	5	.....	.....	.....	.....	3	.....	.....	.....	23	.....	.....
1,320	120	40	14	.....	.....	.....	39	.....	12	.....	58	.....	.....
1,540	140	79	28	3	.....	.....	78	.....	25	.....	86	.....	.....
1,760	160	107	43	9	6	23	101	.....	51	.....	107	14	.....
1,960	180	124	60	29	8	50	110	2	51	.....	107	14	.....
2,200	200	128	72	56	29	82	115	5	83	22	126	32	.....
2,750	250	150	101	98	59	133	140	49	109	59	140	46	9
3,300	300	162	130	107	71	152	152	60	142	74	161	90	28
3,850	350	182	162	137	95	172	173	88	162	103	196	130	59
4,400	400	190	187	162	106	176	193	101	175	128	207	149	106
4,950	450	201	222	186	128	188	223	126	185	139	210	162	128
5,500	500	208	238	195	136	197	233	133	195	161	233	195	151

[a] February 17 to December 31.
[b] Flow for missing days estimated from Millville records.

NOTE.—During the period covered by this table the minimum flow was 900 second-feet, giving 82 horsepower per foot of fall, on 6 days (two 3-day periods) in October, 1904.

SOUTH BRANCH OF POTOMAC RIVER NEAR SPRINGFIELD, W. VA.

A gaging station was established at the Baltimore and Ohio Railroad bridge, 3 miles southwest of Springfield, in April, 1894. This station was discontinued in 1896 for want of an observer. On June 26, 1899, a station was established at the highway bridge 1.5 miles

below the original station, near Grace station. This bridge was carried away by flood in February, 1902. The present station was established August 28, 1903, and was discontinued July 14, 1906. It is located at the steel highway bridge, 2.5 miles east of Springfield, W. Va. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 60, and in Water-Supply Paper No. 192, where are given also the data for previous years.

Discharge measurements of South Branch of Potomac River near Springfield, W. Va., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq.-ft.*	*Feet.*	*Sec.-ft.*
March 17 [a]	Bolster and Padgett	146	620	4.50	1,980
May 26	Robert Follansbee	146	346	2.63	455

[a] Measurement may have been affected by ice about the pivot point of the meter.

Daily gage height, in feet, of South Branch of Potomac River near Springfield, W. Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	4.0	4.05	2.6	9.65	4.85	2.8	3.0
2	3.95	3.85	2.7	8.75	4.55	2.7	2.8
3	3.85	3.55	2.8	7.85	4.35	2.7	2.68
4	6.75	3.4	7.05	6.25	4.2	2.8	2.7
5	8.65	3.4	6.65	5.3	4.0	2.7	3.15
6	6.7	3.2	5.65	5.4	4.15	2.7	2.9
7	5.3	3.05	4.8	5.15	3.9	2.85	2.85
8	4.6	3.0	4.35	4.95	4.0	2.85	2.55
9	4.15	3.0	4.05	4.65	3.85	2.85	2.4
10	3.75	3.1	3.85	5.35	3.7	2.85	2.48
11	3.6	2.9	3.65	5.45	3.65	2.65	2.3
12	3.9	2.9	3.5	5.15	3.4	2.5	2.25
13	4.3	2.85	3.35	4.75	3.3	2.58	2.3
14	4.5	2.7	3.3	4.4	3.25	2.4	2.1
15	4.55	2.7	3.65	5.4	3.2	2.5	.....
16	5.15	2.7	4.25	6.6	3.4	2.7	.....
17	5.2	2.6	4.45	5.9	3.3	2.7	.....
18	4.75	2.5	4.4	5.5	3.2	2.75	.....
19	4.45	2.4	4.4	4.85	3.1	2.9	.....
20	4.05	2.4	4.8	4.45	3.0	3.0	.....
21	3.85	2.6	5.15	4.0	3.05	3.85	.....
22	3.75	2.65	5.65	3.85	2.85	4.0	.....
23	5.15	2.7	6.1	3.75	2.75	3.65	.....
24	9.5	2.6	5.95	3.65	2.7	3.35	.....
25	7.2	2.6	5.35	3.6	2.6	3.5	.....
26	5.25	2.6	5.6	6.35	2.6	4.2	.....
27	4.85	2.6	8.65	9.85	2.5	4.1	.....
28	4.65	2.6	13.55	7.3	2.6	3.45	.....
29	4.75	.....	10.85	5.75	2.7	3.05	.....
30	4.45	.....	10.65	5.05	2.65	3.0	.....
31	4.25	.....	10.95	.....	2.7	.....	.....

NOTE.—Discharge probably not materially affected by ice during 1906.

Rating table for South Branch of Potomac River near Springfield, W. Va., for 1903 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	163	3.30	947	4.50	2,502	6.40	5,540
2.20	210	3.40	1,039	4.60	2,440	6.60	5,970
2.30	261	3.50	1,135	4.70	2,582	6.80	6,420
2.40	315	3.60	1,235	4.80	2,728	7.00	6,890
2.50	372	3.70	1,339	4.90	2,879	7.20	7,370
2.60	432	3.80	1,447	5.00	3,035	7.40	7,870
2.70	495	3.90	1,558	5.20	3,355	7.60	8,370
2.80	561	4.00	1,672	5.40	3,690	7.80	8,870
2.90	630	4.10	1,790	5.60	4,030	8.00	9,370
3.00	702	4.20	1,912	5.80	4,380	9.00	12,000
3.10	778	4.30	2,038	6.00	4,745	10.00	15,000
3.20	860	4.40	2,168	6.20	5,130		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1903-1906. It is well defined between gage heights 2 feet and 4.5 feet. Above 10 feet gage height the discharge is approximate.

Monthly discharge of South Branch of Potomac River near Springfield, W. Va., for 1906.

[Drainage area, 1,470 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	13,500	1,240	3,320	2.26	2.61
February	1,730	315	664	.452	.47
March	25,600	432	5,080	3.45	3.98
April	14,600	1,240	4,540	3.09	3.45
May	2,800	372	1,080	.738	.85
June	1,910	315	770	.524	.58
July 1-14	819	163	449	.305	.16

NOTE.—Values for January, March, and April are good; those for February, May, June, and July are excellent.

SAVAGE RIVER AT BLOOMINGTON, MD.

This station was established May 3, 1905, and was discontinued July 15, 1906. It is located at a highway bridge about 800 feet above the junction of Savage River with North Branch of Potomac. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 63, and in Water-Supply Paper No. 192, where are given also the data for previous years.

Discharge measurements of Savage River at Bloomington, Md., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 16	Bolster and Padgett	35	68	2.95	87
April 10	R. H. Bolster	46	185	5.60	1,139
Do	do	46	175	5.40	1,027
April 11	do	46	148	4.79	685
May 28	Robert Follansbee	43	89	3.25	141

Daily gage height, in feet, of Savage River at Bloomington, Md., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	2.8	2.75	2.53	5.32	3.22	3.35	2.48
2	2.75	2.55	2.43	4.82	3.18	3.28	2.38
3	3.05	2.65	2.73	4.98	3.32	2.95	2.28
4	4.28	3.03	4.45	5.22	3.22	2.75	2.2
5	4.52	2.75	3.83	5.88	3.0	2.75	2.12
6	4.15	2.6	3.5	5.92	3.0	3.35	1.98
7	3.85	2.67	3.37	4.88	2.92	4.62	1.88
8	3.6	2.6	3.25	4.48	2.82	5.15	1.88
9	3.3	2.53	3.17	4.42	2.82	4.05	1.98
10	3.12	2.6	3.15	5.95	2.8	3.6	1.88
11	3.18	2.37	2.97	4.9	2.72	3.32	1.92
12	3.2	2.47	3.05	4.35	2.68	3.05	1.88
13	2.75	2.5	2.87	3.95	2.58	2.88	1.88
14	3.18	2.47	2.93	3.8	2.52	3.05	1.92
15	3.02	2.37	3.2	4.78	2.52	2.85	1.78
16	3.25	2.4	2.93	4.6	2.48	2.65	.....
17	3.52	2.47	2.88	4.3	2.38	2.55	.....
18	3.68	2.27	2.74	4.05	2.32	2.38	.....
19	4.02	2.33	2.78	3.75	2.42	2.3	.....
20	4.0	2.33	2.95	3.55	2.32	2.52	.....
21	4.15	2.47	2.9	3.52	2.3	2.98	.....
22	4.32	2.63	2.98	3.4	2.3	2.82	.....
23	7.08	2.63	2.75	3.48	2.25	2.78	.....
24	5.5	2.35	3.18	3.4	2.2	2.78	.....
25	4.55	2.47	3.05	3.52	2.2	2.62	.....
26	4.1	2.37	3.05	3.62	2.2	2.65	.....
27	3.6	2.23	4.85	3.65	2.42	2.78	.....
28	3.52	2.25	6.5	3.58	3.4	2.75	.....
29	3.48	.....	6.0	3.48	3.35	2.55	.....
30	3.2	.....	7.15	3.35	2.95	2.42	.....
31	3.18	.....	6.05	.....	2.82	.....	.....

NOTE.—No ice conditions during 1906.

Rating table for Savage River at Bloomington, Md., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.70	8	3.00	98	4.30	458	5.60	1,150
1.80	10	3.10	114	4.40	500	5.70	1,215
1.90	12	3.20	132	4.50	544	5.80	1,280
2.00	15	3.30	152	4.60	591	5.90	1,345
2.10	19	3.40	174	4.70	640	6.00	1,415
2.20	23	3.50	197	4.80	691	6.20	1,555
2.30	28	3.60	222	4.90	744	6.40	1,695
2.40	34	3.70	249	5.00	799	6.60	1,840
2.50	41	3.80	278	5.10	855	6.80	1,990
2.60	50	3.90	310	5.20	912	7.00	2,140
2.70	60	4.00	344	5.30	970		
2.80	71	4.10	380	5.40	1,030		
2.90	84	4.20	418	5.50	1,090		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1905 and 1906. It is well defined between gage heights 2.4 feet and 5.6 feet.

Monthly discharge of Savage River at Bloomington, Md., for 1905–6.

[Drainage area, 120 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
May	399	34	97.8	0.815	0.88
June	568	29	118	.983	1.10
July	466	12	85.0	.708	.82
August	210	10	34.0	.283	.33
September	535	8	56.0	.467	.52
October	509	10	82.1	.684	.79
November	418	13	51.1	.426	.48
December	924	21	220	1.83	2.11

Monthly discharge of Savage River at Bloomington, Md., for 1905–6—Continued.

Month.	Discharge second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1906.					
January	2,204	66	330	2.75	3.17
February	103	24	43.8	.365	.38
March	2,260	36	348	2.90	3.34
April	1,380	163	521	4.34	4.84
May	174	23	69.9	.582	.67
June	884	28	138	1.15	1.28
July 1-15	40	10	17.8	.148	.08

NOTE.—Values for 1905 and 1906 are excellent, except July, 1906, which is good.

GEORGES CREEK AT WESTERNPORT, MD.

This station was established May 4, 1905, and was discontinued July 15, 1906. It is located at the highway bridge in Westernport, Md., about one-half mile above the mouth of the creek. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 64, and in Water-Supply Paper No. 192, where are given also the data for previous years.

Discharge measurements of Georges Creek at Westernport, Md., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 16	Bolster and Padgett	41	27	1.49	65
March 30	Robert Follansbee	95	180	3.38	1,230
April 10	R. H. Bolster	93	98	2.50	478
May 28	Robert Follansbee	93	70	2.25	353

Daily gage height, in feet, of Georges Creek at Westernport, Md., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	1.68	1.8	1.6	3.18	1.68	1.65	1.18
2	1.55	1.8	1.78	2.98	1.72	1.55	1.15
3	2.3	1.75	2.05	2.88	1.62	1.55	1.15
4	2.58	1.72	2.1	2.92	1.52	1.32	1.1
5	2.45	1.68	2.02	2.85	1.5	1.6	1.1
6	2.38	1.65	1.98	2.52	1.55	1.68	1.1
7	2.2	1.6	1.8	2.32	1.5	2.22	1.05
8	2.2	1.55	1.75	2.32	1.5	2.25	1.05
9	1.88	1.52	1.68	2.55	1.45	1.95	1.05
10	1.95	1.5	1.6	2.58	1.4	1.8	1.1
11	1.95	1.45	1.55	2.32	1.4	1.72	1.1
12	2.0	1.45	1.52	2.32	1.4	1.75	1.1
13	1.95	1.42	1.5	2.22	1.4	1.75	1.1
14	1.88	1.4	1.5	2.22	1.42	1.7	1.05
15	1.78	1.4	1.5	2.2	1.4	1.62	1.02
16	1.82	1.4	1.45	2.22	1.3	1.55	.....
17	2.0	1.4	1.32	2.12	1.32	1.25	.....
18	2.05	1.4	1.32	2.12	1.32	1.2	.....
19	2.12	1.4	1.38	2.22	1.25	1.2	.....
20	2.15	1.45	1.5	2.0	1.22	1.35	.....
21	2.18	1.45	1.55	2.05	1.2	1.35	.....
22	2.22	1.4	1.58	1.9	1.2	1.35	.....
23	3.28	1.35	1.55	1.88	1.15	1.38	.....
24	3.08	1.32	1.58	1.88	1.15	1.4	.....
25	2.68	1.3	1.6	1.82	1.1	1.3	.....
26	2.2	1.3	1.68	1.9	1.1	1.32	.....
27	2.12	1.38	2.62	1.85	2.02	1.38	.....
28	2.1	1.42	3.2	1.75	2.08	1.25	.....
29	2.05	.....	3.2	1.7	2.2	1.2	.....
30	1.98	.....	3.42	1.72	1.95	1.2	.....
31	1.9	.....	3.45	.....	1.88	.....	.....

NOTE.—Discharge probably unaffected by ice.

Rating tables for Georges Creek at Westernport, Md.

MAY 4 TO JUNE 6, 1905.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	22	1.40	38	1.60	66	1.80	112
1.30	29	1.50	50	1.70	87		

JUNE 7 TO SEPTEMBER 10, 1905.[b]

1.00	8	1.70	64	2.40	301	3.10	780
1.10	11	1.80	84	2.50	355	3.20	865
1.20	15	1.90	108	2.60	415	3.30	955
1.30	20	2.00	137	2.70	480	3.40	1,045
1.40	27	2.10	170	2.80	550	3.50	1,140
1.50	36	2.20	208	2.90	625		
1.60	48	2.30	252	3.00	700		

SEPTEMBER 11, 1905, TO JULY 15, 1906.[c]

0.90	10	1.70	115	2.50	495	3.30	1,150
1.00	15	1.80	145	2.60	560	3.40	1,250
1.10	21	1.90	180	2.70	630	3.50	1,350
1.20	29	2.00	220	2.80	705	3.60	1,455
1.30	39	2.10	265	2.90	785	3.70	1,560
1.40	52	2.20	315	3.00	870	3.80	1,670
1.50	69	2.30	370	3.10	960	3.90	1,780
1.60	90	2.40	430	3.20	1,055	4.00	1,895

[a] This table is based on one discharge measurement made during 1905 and on the form of the 1906 curve. It is not well defined.

[b] This table is based on three discharge measurements made during 1905 and on the form of the 1906 curve. It is fairly well defined between gage heights 1.5 feet and 2 feet.

[c] This table is applicable only for open-channel conditions. It is based on five discharge measurements made during 1905 and 1906. It is well defined between gage heights 1.3 feet and 3.5 feet.

Monthly discharge of Georges Creek at Westernport, Md., for 1905–6.

[Drainage area, 76 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
May 4–31	92	26	44.8	0.589	0.61
June	154	15	45.7	.601	.67
July	1,090	13	127	1.67	1.92
August	68	6	15.1	.199	.229
September	528	8	46.4	.611	.68
October	370	12	65.8	.866	1.00
November	102	12	33.8	.445	.50
December	1,250	39	267	3.51	4.05
1906.					
January	1,130	80	320	4.21	4.85
February	145	39	71.2	.937	.98
March	1,300	42	260	3.42	3.94
April	1,040	115	378	4.97	5.54
May	315	21	83.0	1.09	1.26
June	342	29	91.4	1.20	1.34
July 1–14	27	16	20.8	.274	.15

NOTE.—Values given above are rated as follows: May, 1905, fair; August to October, 1905, approximate; remainder of 1905 and 1906, good.

WILLS CREEK AT CUMBERLAND, MD.

This station was established May 5, 1905, and was discontinued July 14, 1906. It is located at the highway bridge at the upper end of "The Narrows," Cumberland, Md. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 65, and in Water-Supply Paper No. 192, where are given also the data for previous years.

Discharge measurements of Wills Creek at Cumberland, Md., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 17	Bolster and Padgett	77	213	4.01	175
April 2	Robert Follansbee	115	467	6.32	1,490
April 10	R. H. Bolster	110	429	6.05	1,200
April 11	do	106	404	5.88	1,070
May 26	Robert Follansbee	69	169	3.27	55

Daily gage height, in feet, of Wills Creek at Cumberland, Md., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	4.45	4.25	3.5	6.7	4.02	3.5	3.35
2	4.25	4.05	3.5	6.3	4.25	3.48	3.3
3	4.45	3.7	4.15	6.3	4.18	3.38	3.25
4	5.95	4.02	5.25	6.2	4.08	3.3	3.25
5	5.78	4.02	4.6	6.32	4.0	3.5	3.2
6	5.5	3.7	4.25	6.32	4.0	3.65	3.18
7	5.12	3.6	4.25	5.45	3.9	6.6	3.15
8	4.95	3.68	4.3	5.3	3.88	5.5	3.1
9	4.65	3.75	4.22	5.6	3.8	4.75	3.05
10	4.38	3.75	4.18	6.0	3.8	4.3	3.05
11	4.32	3.7	4.12	5.9	3.8	4.0	3.05
12	4.45	3.7	4.08	5.6	3.75	3.8	3.18
13	4.42	3.6	4.02	5.42	3.7	3.78	3.08
14	4.4	3.68	4.05	5.1	3.65	3.72	3.02
15	4.45	3.65	4.05	6.3	3.6	3.68	.....
16	4.7	3.6	4.1	5.92	3.55	3.6	.....
17	5.0	3.55	4.1	5.58	3.6	3.55	.....
18	4.88	3.5	4.1	5.32	3.52	3.62	.....
19	5.1	3.5	4.1	5.02	3.48	3.85	.....
20	5.02	3.5	4.18	4.88	3.45	3.9	.....
21	5.12	3.7	4.2	4.72	3.45	3.88	.....
22	5.25	3.68	4.2	4.68	3.4	3.78	.....
23	7.3	3.58	4.2	4.62	3.4	3.78	.....
24	6.95	3.55	4.2	4.52	3.35	3.7	.....
25	5.88	3.65	4.2	4.5	3.3	3.58	.....
26	5.48	3.5	4.2	4.45	3.3	3.52	.....
27	5.08	3.5	6.1	4.4	3.5	3.5	.....
28	4.9	3.5	7.7	4.32	3.9	3.55	.....
29	4.75	.....	7.2	4.22	3.65	3.5	.....
30	4.55	.....	7.05	4.12	3.55	3.38	.....
31	4.42	.....	7.9	.....	3.4	.....	.....

NOTE.—Discharge probably not affected by ice.

Rating table for Wills Creek at Cumberland, Md., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.00	30	3.90	164	4.80	442	6.40	1,560
3.10	38	4.00	188	4.90	482	6.60	1,785
3.20	48	4.10	214	5.00	525	6.80	2,030
3.30	60	4.20	241	5.20	620	7.00	2,295
3.40	73	4.30	270	5.40	735	7.20	2,575
3.50	88	4.40	301	5.60	860	7.40	2,870
3.60	104	4.50	334	5.80	1,005	7.60	3,170
3.70	122	4.60	368	6.00	1,170	7.80	3,480
3.80	142	4.70	404	6.20	1,355		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 9 discharge measurements made during 1905 and 1906. It is well defined between gage heights 3 feet and 6.5 feet.

Monthly discharge of Wills Creek at Cumberland, Md., for 1905–6.

[Drainage area, 240 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
May 6–31	747	91	221	0.921	0.89
June	1,350	104	272	1.13	1.26
July	1,900	96	353	1.47	1.70
August	1,040	36	174	.725	.84
September	647	34	128	.533	.60
October	595	30	149	.621	.72
November	570	48	115	.479	.53
December	2,410	63	529	2.20	2.54
1906.					
January	2,720	256	637	2.65	3.06
February	256	88	122	.508	.53
March	3,640	88	626	2.61	3.01
April	1,900	219	806	3.36	3.75
May	256	60	126	.525	.60
June	1,780	60	207	.862	.96
July 1–14	66	32	44.6	.186	.10

NOTE.—All the above values are excellent.

OPEQUON CREEK NEAR MARTINSBURG, W. VA.

This station was established May 8, 1905, and was discontinued July 15, 1906. It is located at the highway bridge known as Rileys Ford Bridge, about 4 miles southeast of Martinsburg, W. Va. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 67, and in Water-Supply Paper No. 192, where are given also the data for previous years.

Discharge measurements of Opequon Creek near Martinsburg, W. Va., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 18	Bolster and Padgett	75	59	1.51	137
April 2	Robert Follansbee	80	213	3.32	600
April 12	R. H. Bolster	78	134	2.57	338
Do	do	78	132	2.56	332
May 29	Robert Follansbee	75	66	1.57	152

Daily gage height, in feet, of Opequon Creek near Martinsburg, W. Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	1.73	1.6	1.26	4.72	1.92	1.5	1.7
2	1.65	1.6	1.4	3.48	1.9	1.48	1.55
3	1.77	1.55	1.56	3.0	1.88	1.45	1.9
4	8.73	1.48	3.24	2.72	1.85	1.42	7.9
5	4.2	1.45	2.4	2.55	1.82	1.4	2.88
6	3.12	1.4	1.9	2.45	1.8	2.92	2.4
7	2.68	1.37	1.84	2.32	1.78	2.18	2.4
8	2.27	1.33	1.8	2.22	1.75	1.58	1.88
9	2.15	1.32	1.72	2.48	1.72	1.58	1.78
10	1.98	1.37	1.6	4.02	1.68	1.62	1.72
11	1.92	1.4	1.52	3.02	1.65	1.48	1.68
12	1.9	1.4	1.48	2.48	1.65	1.42	1.62
13	1.98	1.4	1.48	2.25	1.62	1.48	1.6
14	2.17	1.45	1.5	2.18	1.6	1.58	1.58
15	2.7	1.48	1.52	8.5	1.58	1.52	1.52
16	2.58	1.42	1.52	5.0	1.55	1.48	.....
17	2.25	1.4	1.52	3.28	1.52	5.38	.....
18	2.32	1.4	1.58	2.9	1.5	3.0	.....
19	1.98	1.4	1.72	2.62	1.5	2.75	.....
20	1.85	1.38	1.83	2.45	1.5	2.48	.....
21	1.78	1.37	1.82	2.35	1.48	5.18	.....
22	1.72	1.48	1.92	2.28	1.45	5.0	.....
23	1.75	1.42	2.28	2.22	1.45	2.58	.....
24	1.93	1.38	2.3	2.15	1.42	2.35	.....
25	1.85	1.35	2.35	2.1	1.4	2.18	.....
26	1.8	1.32	2.78	2.3	1.4	2.05	.....
27	1.75	1.3	4.0	2.25	1.42	1.88	.....
28	1.7	1.28	7.52	2.0	1.52	1.82	.....
29	1.67	.....	5.45	1.98	1.52	2.08	.....
30	1.65	.....	5.78	1.95	1.48	1.85	.....
31	1.63	.....	7.2	.....	1.4	.....	.....

NOTE.—Discharge probably not affected by ice.

Rating tables for Opequon Creek near Martinsburg, W. Va.

MAY 9 TO JUNE 4, 1905.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.15	116	1.40	152	1.70	200	2.00	257
1.20	123	1.50	167	1.80	218		
1.30	137	1.60	183	1.90	237		

OCTOBER 8 TO DECEMBER 20, 1905.[b]

1.10	50	1.50	88	1.90	140	2.30	205
1.20	58	1.60	100	2.00	155	2.40	223
1.30	67	1.70	113	2.10	171	2.50	242
1.40	77	1.80	126	2.20	188		

DECEMBER 21, 1905, TO JULY 15, 1906.[c]

1.20	97	2.60	343	4.00	897	5.80	1,825
1.30	109	2.70	371	4.10	945	6.00	1,935
1.40	122	2.80	402	4.20	993	6.20	2,045
1.50	135	2.90	436	4.30	1,042	6.40	2,155
1.60	149	3.00	472	4.40	1,092	6.60	2,265
1.70	164	3.10	510	4.50	1,142	6.80	2,375
1.80	180	3.20	549	4.60	1,193	7.00	2,485
1.90	197	3.30	589	4.70	1,244	7.20	2,595
2.00	214	3.40	630	4.80	1,295	7.40	2,705
2.10	232	3.50	672	4.90	1,347	7.60	2,815
2.20	251	3.60	715	5.00	1,399	7.80	2,925
2.30	271	3.70	759	5.20	1,504	8.00	3,035
2.40	293	3.80	804	5.40	1,610		
2.50	317	3.90	850	5.60	1,717		

[a] This curve has been drawn through one measurement and parallel to the other curves at this station.
[b] This rating curve has been drawn through one measurement and parallel to the other curves at this station.
[c] This table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1906. Above gage height 6 feet the rating curve is a tangent, the difference being 55 per tenth.

Monthly discharge of Opequon Creek near Martinsburg, W. Va., for 1905–6.

[Drainage area, 275 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
May 9–31	253	116	144	0.524	0.45
June 1–4	140	123	131	.476	.07
October 8–31	155	50	67.4	.245	.22
November	90	50	61.1	.222	.25
December	2,830	54	337	1.23	1.42
1906.					
January	3,440	153	352	1.28	1.48
February	149	107	123	.447	.47
March	2,770	104	480	1.75	2.02
April	3,310	205	509	1.85	2.06
May	200	122	151	.549	.63
June	1,600	122	338	1.23	1.37
July 1–15	2,980	138	387	1.41	.79

NOTE.—Values are rated as follows: 1905, approximate; January and February, 1906, approximate; March to July, 1906, good; daily discharge above 1,500 second-feet, approximate.

SHENANDOAH RIVER AT MILLVILLE, W. VA.

This station was established April 15, 1895. It is located about one-fourth mile above the Baltimore and Ohio Railroad station at Millville, W. Va. The highway runs within a few rods of the stream at the gaging station. The station is best reached by driving from Harpers Ferry, W. Va. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 71, and in Water-Supply Paper No. 192, where are given also the data for previous years.

The following discharge measurement was made May 29, 1906:

Width, 488 feet; area, 1,720 square feet; gage height, 1.58 feet; discharge, 1,790 second-feet.

Daily gage height, in feet, of Shenandoah River at Millville, W. Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.7	2.3	1.1	4.75	2.3	1.5	2.0	1.3	3.55	1.45	2.7	1.85
2	2.45	2.2	1.1	4.2	2.2	1.5	1.8	1.4	3.8	1.45	2.5	1.8
3	2.25	2.0	1.2	3.8	2.1	1.4	1.6	1.8	2.7	1.4	2.4	1.75
4	3.4	2.4[a]	2.2	3.4	2.0	1.3	1.3	1.4	2.2	1.7	2.3	1.7
5	5.3	2.0	2.5	3.1	1.95	1.2	2.15	2.5	2.2	2.5	2.2	1.65
6	4.5	1.95	3.5	2.9	1.9	2.1	1.7	2.3	2.0	3.5	2.1	1.7
7	3.6	1.9	2.9	2.7	1.85	1.3	1.55	2.1	1.9	3.1	2.05	1.65
8	3.0	1.8	2.5	2.6	1.8	1.2	1.6	2.0	1.8	2.6	2.0	1.6
9	2.7	1.6	2.3	2.4	2.1	1.2	1.5	2.2	1.65	2.3	1.9	1.55
10	2.45	1.6	2.1	2.45	2.05	1.65	1.35	2.3	1.6	2.05	1.85	1.5
11	2.3	1.75	2.0	2.6	1.9	1.9	1.3	2.0	1.5	1.8	1.8	1.6
12	2.15	1.5	1.9	2.6	1.85	1.5	1.3	2.0	1.5	1.8	1.8	1.65
13	2.0	1.45	1.75	2.45	1.8	1.2	1.3	3.0	1.45	1.65	1.75	1.55
14	2.0	1.3	1.7	2.3	1.7	1.2	1.3	3.4	1.9	1.5	1.75	1.5
15	2.0	1.35	1.7	3.2	1.6	1.2	1.4	3.8	1.6	1.4	1.75	1.4
16	2.2	1.3	1.8	4.7	1.55	2.0	1.3	3.9	1.5	1.4	1.7	1.45
17	2.3	1.3	1.9	4.2	1.4	2.6	1.3	3.2	1.35	1.4	1.65	1.7
18	2.25	1.2	2.6	3.6	1.35	2.1	1.3	4.1	1.3	1.5	1.6	4.2
19	2.2	1.2	2.7	3.2	1.45	3.8	1.4	3.35	1.35	4.1	1.8	4.5
20	2.1	1.2	2.7	2.95	1.4	2.4	1.5	4.2	1.3	11.3	2.25	4.0

[a] Backwater from ice, February 4.

Daily gage height, in feet, of Shenandoah River at Millville, W. Va., for 1906—Continued.

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	2.0	1.2	2.7	2.7	1.3	2.7	1.4	3.9	1.25	12.8	4.3	3.5
22	1.9	1.2	2.9	2.5	1.25	4.8	1.3	3.4	1.2	8.3	3.8	3.6
23	1.8	1.2	3.15	2.4	1.2	3.7	1.2	3.3	1.2	6.5	3.85	3.4
24	1.8	1.2	3.1	2.25	1.2	2.9	2.0	4.0	1.2	5.7	2.9	3.0
25	3.8	1.15	2.9	2.1	1.15	2.5	1.6	4.5	1.1	4.9	2.7	2.6
26	3.2	1.1	2.9	2.0	1.1	2.15	1.5	4.5	1.25	4.2	2.7	2.2
27	2.7	1.1	3.0	2.0	1.2	2.4	1.4	3.8	1.25	3.8	2.25	2.0
28	2.5	1.1	4.8	3.4	1.3	3.5	1.4	5.4	1.25	3.5	2.15	2.4
29	2.4	.....	4.9	2.9	1.5	3.25	1.4	4.7	1.25	3.2	2.1	2.4
30	2.4	.....	4.6	2.5	1.4	2.4	1.5	5.0	1.35	3.0	2.0	2.25
31	2.5	.....	4.6	.....	1.4	.....	1.3	4.2	.....	2.8	.....	2.2

Rating table for Shenandoah River at Millville, W. Va., for 1905-6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	1,090	2.40	3,130	3.70	6,100	6.00	14,240
1.20	1,200	2.50	3,330	3.80	6,380	6.20	15,120
1.30	1,320	2.60	3,530	3.90	6,670	6.40	16,000
1.40	1,450	2.70	3,730	4.00	6,960	6.60	16,920
1.50	1,580	2.80	3,940	4.20	7,560	6.80	17,840
1.60	1,720	2.90	4,150	4.40	8,200	7.00	18,800
1.70	1,870	3.00	4,370	4.60	8,860	8.00	24,020
1.80	2,030	3.10	4,600	4.80	9,540	9.00	30,400
1.90	2,200	3.20	4,840	5.00	10,260	10.00	37,500
2.00	2,380	3.30	5,080	5.20	11,020	11.00	45,100
2.10	2,560	3.40	5,320	5.40	11,780	12.00	53,500
2.20	2,750	3.50	5,570	5.60	12,580	13.00	62,700
2.30	2,940	3.60	5,830	5.80	13,400		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 15 discharge measurements made during 1895 and 1904-1906. It is well defined between gage heights 0.4 foot and 5.2 feet. Values above 5 feet are based on a discharge curve, which is the product of a well-defined area curve and a fairly accurate extension of the velocity curve.

Monthly discharge of Shenandoah River at Millville, W. Va., for 1906.

[Drainage area, 3,000 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	11,400	2,030	3,720	1.24	1.43
February	2,940	1,090	1,640	.548	.57
March	9,900	1,090	3,890	1.30	1.50
April	9,370	2,380	4,460	1.49	1.66
May	2,940	1,090	1,800	.601	.69
June	9,540	1,200	2,900	.965	1.08
July	2,660	1,200	1,580	.527	.61
August	11,800	1,320	5,220	1.74	2.01
September	6,380	1,090	1,980	.660	.74
October	60,800	1,450	8,250	2.75	3.17
November	7,880	1,720	3,020	1.01	1.13
December	8,520	1,450	3,050	1.02	1.18
The year	60,800	1,090	3,460	1.15	15.77

NOTE.—The discharge for February 4 was corrected for backwater. Values are rated as follows: 1906, excellent; discharge above 25,000 second-feet, fair.

The following table gives the horsepower (80 per cent efficiency) per foot of fall that may be developed at different rates of discharge, and shows the number of days on which the flow and the corresponding horsepower were respectively less than the amounts given in the columns for "discharge" and "horsepower:"

Discharge and horsepower table for Shenandoah River at Millville, W. Va., from 1895 to 1906.

Discharge in second-feet.	Horsepower (80 per cent efficiency) per foot fall.	Number of days of deficient flow.											
		1895.[a]	1896.	1897.	1898.	1899.[b]	1900.	1901.	1902.	1903.	1904.	1905.	1906.
485	.....	5	.....	.....	.....	.....	.....	.....	.....	.....	15	.....	.....
550	50	33	4	.....	.....	.....	.....	.....	.....	.....	73	9	.....
660	60	98	24	50	.....	3	20	.....	5	1	106	60	.....
770	70	118	26	67	.....	29	54	1	26	8	114	73	.....
880	80	125	34	85	7	70	89	11	63	19	122	101	.....
990	90	154	75	107	11	112	109	38	97	37	133	137	.....
1,100	100	160	82	146	32	141	128	55	112	59	147	155	7
1,320	120	166	89	179	91	167	161	78	145	82	180	180	36
1,540	140	185	130	210	116	184	202	104	167	118	215	208	85
1,760	160	192	192	220	143	194	219	120	174	129	234	238	116

[a] April 15 to December 31.
[b] Missing days estimated from Point of Rocks records.

NOTE.—From April 15, 1895, to December 31, 1906, the minimum flow was 480 second-feet, giving 44 horsepower per foot of fall on 5 consecutive days in October, 1895, and on 15 days (5 consecutive) in October and November, 1904.

SOUTH FORK OF SHENANDOAH RIVER NEAR FRONT ROYAL, VA.

This station was established June 26, 1899, and was discontinued July 16, 1906. It is located about 1 mile above the bridge, which is near the Norfolk and Western Railway station. The conditions at this station and the bench marks are described in Water Supply Paper No. 167, page 74, and in Water Supply Paper No. 192, where are given also the data for previous years.

The following discharge measurement was made June 16, 1906:

Width, 300 feet; area, 906 square feet; gage height, 4.70 feet; discharge, 1,070 second-feet.

Daily gage height, in feet, of South Fork of Shenandoah River near Front Royal, Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	5.65	5.43	4.2	7.05	5.22	4.7	5.45
2	5.45	5.3	4.17	6.8	5.1	4.62	5.28
3	5.25	5.2	4.23	6.45	5.0	4.5	5.25
4	6.13	5.1	5.05	6.25	4.95	4.42	5.25
5	8.47	4.85	7.02	5.85	4.9	4.38	4.9
6	7.22	4.82	6.33	5.68	4.85	4.3	4.45
7	6.4	4.9	5.8	5.52	4.88	4.22	4.65
8	6.0	4.73	5.47	5.4	5.0	4.2	4.62
9	5.65	4.65	5.15	5.32	5.1	4.18	4.4
10	5.38	4.5	5.15	5.3	5.05	4.1	4.28
11	5.17	4.52	5.05	5.4	5.0	4.1	4.3
12	5.0	4.45	4.9	5.35	4.9	4.15	4.38
13	5.0	4.4	4.83	5.28	4.8	4.22	5.32
14	5.0	4.4	4.7	5.2	4.78	4.2	4.65
15	5.05	4.43	4.8	6.35	4.6	4.4	4.4

Daily gage height, in feet, of South Fork of Shenandoah River near Front Royal, Va., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
16	5.3	4.32	5.25	7.75	4.62	4.65	4.25
17	5.3	4.4	5.95	6.8	4.52	5.45	.....
18	5.3	4.33	5.77	6.38	4.55	5.75	.....
19	5.2	4.3	5.8	6.08	4.45	5.35	.....
20	5.12	4.3	5.75	5.8	4.4	5.35	.....
21	5.0	4.3	5.8	5.55	4.35	6.2	.....
22	4.9	4.25	6.1	5.45	4.3	6.9	.....
23	4.93	4.22	5.9	5.35	4.28	6.05	.....
24	6.8	4.28	5.8	5.25	4.2	5.5	.....
25	6.85	4.25	5.6	5.05	4.2	5.35	.....
26	6.22	4.25	5.58	5.1	4.2	5.28	.....
27	5.75	4.12	5.77	5.35	4.22	5.72	.....
28	5.63	4.25	6.75	5.45	4.3	6.15	.....
29	5.6	.....	7.35	5.4	4.65	5.5	.....
30	5.55	.....	7.1	5.3	4.4	5.35	.....
31	5.55	.....	6.9	.....	4.72	.....	.....

NOTE.—Discharge probably unaffected by ice.

Rating table for South Fork of Shenandoah River near Front Royal, Va., for 1904–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.10	610	5.10	1,460	6.10	2,790	7.20	4,680
4.20	670	5.20	1,570	6.20	2,940	7.40	5,080
4.30	740	5.30	1,690	6.30	3,100	7.60	5,480
4.40	810	5.40	1,810	6.40	3,260	7.80	5,900
4.50	890	5.50	1,940	6.50	3,430	8.00	6,320
4.60	970	5.60	2,070	6.60	3,600	8.20	6,760
4.70	1,060	5.70	2,210	6.70	3,770	8.40	7,200
4.80	1,150	5.80	2,350	6.80	3,940		
4.90	1,250	5.90	2,490	6.90	4,120		
5.00	1,350	6.00	2,640	7.00	4,300		

NOTE.—The above table is applicable only for open-channel conditions. It is based on nine discharge measurements made during 1904–1906. It is well defined between gage heights 3.4 feet and 5.3 feet.

Monthly discharge of South Fork of Shenandoah River near Front Royal, Va., for 1906.

[Drainage area, 1,570 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	7,350	1,250	2,280	1.45	1.67
February	1,850	622	957	.610	.64
March	4,980	652	2,230	1.42	1.64
April	5,800	1,400	2,390	1.52	1.70
May	1,590	670	1,050	.668	.77
June	4,120	610	1,460	.932	1.04
July 1–16	1,880	705	1,140	.725	.43

NOTE.—Values for 1906 are excellent.

SOUTH RIVER AT BASIC CITY, VA.

This station was established June 29, 1905, in connection with the investigation of stream pollution in the Shenandoah Valley, and was discontinued July 15, 1906. It is located at the highway bridge one-half mile below the Chesapeake and Ohio Railway bridge at

Basic City, Va. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 76, and in Water-Supply Paper No. 192, where are given also references to publications that contain data for previous years.

Discharge measurements of South River at Basic City, Va., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 11	Robert Follansbee	72	206	3.25	221
June 14	Follansbee and Padgett	70	158	2.69	86

Daily gage height, in feet, of South River at Basic City, Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	3.0	3.4	2.8	3.6	2.9	2.75	2.6
2	2.9	3.3	2.8	3.6	2.9	2.7	2.6
3	3.2	3.2	5.3	3.5	2.8	2.6	2.6
4	4.4	3.2	4.9	3.4	2.9	2.6	2.7
5	3.7	3.2	4.0	3.2	2.9	2.5	2.6
6	3.4	3.1	3.8	3.3	2.8	2.4	2.65
7	3.2	3.1	3.5	3.2	3.0	2.6	2.45
8	3.0	3.0	3.5	3.1	3.0	2.6	2.55
9	2.9	2.9	3.3	3.1	2.8	2.5	2.65
10	2.8	2.9	3.0	3.2	2.85	2.5	2.6
11	2.7	2.9	3.1	3.25	2.85	2.4	2.3
12	2.8	2.9	3.1	3.2	2.7	2.5	2.4
13	3.1	2.9	3.1	3.15	2.8	2.6	2.55
14	3.1	2.9	3.0	3.1	2.8	2.7	2.35
15	3.1	2.9	3.1	4.5	2.7	2.6	2.4
16	3.0	2.8	3.2	4.1	2.75	2.6	.....
17	3.0	2.7	3.3	3.75	2.8	3.2	.....
18	3.1	2.7	3.3	3.55	2.65	2.5	.....
19	3.2	2.7	3.3	3.4	2.7	2.8	.....
20	3.2	2.7	3.2	3.25	2.7	5.45	.....
21	3.1	2.7	3.3	3.25	2.6	4.9	.....
22	3.1	2.8	3.2	3.2	2.6	3.45	.....
23	4.9	2.8	3.2	3.2	2.6	3.2	.....
24	4.4	2.8	3.2	3.1	2.5	3.0	.....
25	3.9	*2.8	3.1	3.0	2.6	2.9	.....
26	3.6	2.8	3.2	3.1	2.6	3.2	.....
27	3.6	2.8	3.5	3.05	2.65	2.95	.....
28	3.7	2.8	3.7	3.0	2.75	2.85	.....
29	3.7	.....	3.7	3.0	3.0	2.8	.....
30	3.6	.....	3.5	2.9	2.7	2.7	.....
31	3.5	.....	3.8	.....	2.75	.....	.....

NOTE.—Discharge probably unaffected by ice.

Rating table for South River at Basic City, Va., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	7	2.90	135	3.80	377	4.70	678
2.10	12	3.00	159	3.90	407	4.80	714
2.20	19	3.10	183	4.00	438	4.90	750
2.30	29	3.20	208	4.10	470	5.00	786
2.40	41	3.30	234	4.20	503	5.10	823
2.50	55	3.40	261	4.30	537	5.20	860
2.60	72	3.50	289	4.40	572	5.30	897
2.70	91	3.60	318	4.50	607	5.40	934
2.80	112	3.70	347	4.60	642	5.50	972

NOTE.—The above table is applicable only for open-channel conditions. It is based on 6 discharge measurements made during 1905 and 1906. It is fairly well defined between gage heights 2.5 feet and 4.1 feet.

Monthly discharge of South River at Basic City, Va., for 1905-6.

[Drainage area, 142 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
July	786	41	159	1.12	1.29
August	135	29	70.9	.499	.58
September	208	19	58.2	.410	.46
October	91	12	42.2	.297	.34
November	41	7	23.4	.165	.18
December	972	19	160	1.13	1.30
1906.					
January	750	91	258	1.82	2.10
February	261	91	141	.993	1.03
March	897	112	276	1.94	2.24
April	607	135	241	1.70	1.90
May	159	55	106	.746	.86
June	953	41	154	1.08	1.20
July 1-15	91	29	62.5	.440	.24

NOTE.—Values are rated as follows: July, August, and December, 1905, and all of 1906, excellent; September, 1905, good; October, 1905, fair; November, 1905, approximate; discharge below 25 second-feet, approximate.

LEWIS CREEK NEAR STAUNTON, VA.

This station was established June 30, 1905, in connection with the investigation of stream pollution in the Shenandoah Valley, and was discontinued July 15, 1906. It is located at the private bridge across Lewis Creek, on the property of William Glenn, 2 miles from Staunton. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 77, and in Water-Supply Paper No. 192, where are given also references to publications that contain data for previous years.

Discharge measurements of Lewis Creek near Staunton, Va., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 10	Robert Follansbee	16	13.9	0.83	12.5
June 14	Follansbee & Padgett	15	9.7	.55	6.6

Daily gage height, in feet, of Lewis Creek near Staunton, Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	0.54	0.49	0.74	0.74	0.48	0.54	0.64
2	.43	.53	.70	.70	.53	.53	.53
3	.54	.60	.71	.64	.60	.54	.54
4	1.43	.53	.53	.49	.49	.58	.53
5	.94	.54	.64	.54	.53	.59	.49
6	.83	.53	.59	.48	.54	.48	.53
7	.64	.49	.54	.44	.53	.54	.64
8	.53	.53	.53	.57	.54	.53	.53
9	.49	.44	.71	.44	.43	.49	.54
10	.43	.48	.53	.83	.49	.53	.48
11	.59	.44	.54	.84	.48	.44	.44
12	.48	.53	.59	.73	.49	.53	.48
13	.69	.49	.74	.79	.43	.54	.53
14	.53	.59	.63	.63	.44	.53	.64
15	.59	.54	1.04	.74	.48	.49	.43

Daily gage height, in feet, of Lewis Creek near Staunton, Va., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
16	0.53	0.48	0.83	0.63	0.49	0.63	.....
17	.44	.54	.84	.74	.33	.49	.....
18	.48	.53	.83	.53	.34	.43	.....
19	.59	.49	.84	.49	.48	.49	.....
20	.53	.43	.78	.53	.44	.53	.....
21	.74	.49	.74	.49	.43	.49	.....
22	.63	.53	.70	.53	.49	.43	.....
23	.74	.54	.64	.64	.38	.44	.....
24	.63	.43	.63	.63	.34	.93	.....
25	.54	.54	.64	.54	.33	1.94	.....
26	.48	.53	.59	.54	.94	1.83	.....
27	.54	.49	.54	.59	1.18	.94	.....
28	.63	.43	1.13	.49	1.64	.73	.....
29	.54	.....	.84	.63	1.13	.54	.....
30	.48	.....	.93	.64	.64	.53	.....
31	.44	.....	1.24	.....	.58	.....	.....

NOTE.—Discharge probably unaffected by ice.

Rating tables for Lewis Creek near Staunton, Va.

JULY 1, 1905, TO MAY 27, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.30	1.0	0.60	5.5	0.90	14.9	1.20	29.0
.35	1.4	.65	6.8	.95	16.8	1.25	32.0
.40	1.9	.70	8.2	1.00	18.9	1.30	35.5
.45	2.6	.75	9.7	1.05	21.0	1.35	39.0
.50	3.4	.80	11.3	1.10	23.5	1.40	42.5
.55	4.4	.85	13.0	1.15	26.0	1.45	46.5

MAY 28 TO JULY 15, 1906.[b]

0.25	1.3	0.60	7.9	0.95	20.5	1.60	63
.30	1.8	.65	9.4	1.00	23.0	1.70	71
.35	2.5	.70	11.0	1.10	28.5	1.80	79
.40	3.3	.75	12.7	1.20	34.5	1.90	88
.45	4.2	.80	14.5	1.30	41	2.00	97
.50	5.3	.85	16.3	1.40	48		
.55	6.5	.90	18.3	1.50	55		

[a] This table is applicable only for open-channel conditions. It is based on 3 discharge measurements made during 1905 and 1906. It is fairly well defined between gage heights 0.5 foot and 0.8 foot.

[b] This table is based on 1 discharge measurement made during 1906 and on the form of the preceding curve.

Monthly discharge of Lewis Creek near Staunton, Va., for 1905–6.

[Drainage area, 20 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
July	24.	1.9	6.0	0.299	0.34
August	5.5	1.4	3.2	.158	.18
September	5.5	1.9	2.8	.138	.15
October	19.	1.4	4.6	.229	.26
November	9.7	1.4	3.5	.173	.19
December	6.8	1.9	3.3	.167	.19
1906.					
January	45.	2.3	6.6	.329	.38
February	5.5	2.3	3.6	.180	.19
March	31.	4.0	9.7	.485	.56
April	13.	2.3	6.1	.303	.34
May	66.	1.2	7.4	.370	.43
June	92.	3.8	12.3	.615	.69
July 1–15	9.1	3.8	6.2	.308	.17

NOTE.—Values are rated as follows: July and October, 1905, and January, March, April, and May, 1906, good; remainder of the period fair, except June, which is approximate; discharge below 2 second-feet and above 30 second-feet, approximate.

COOKS CREEK NEAR MOUNT CRAWFORD, VA.

This station was established July 1, 1905, in connection with the investigation of stream pollution in the Shenandoah Valley, and was discontinued July 15, 1906. It is located at the upper highway bridge across Cooks Creek, three-fourths of a mile from Mount Crawford, Va. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 78, and in Water-Supply Paper No. 192, where are given also the data for previous years.

The following measurement was made April 10, 1906:

Width, 31 feet; area, 78 square feet; gage height, 2.32 feet; discharge, 32.4 second-feet.

Daily gage height, in feet, of Cooks Creek at Mount Crawford, Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	2.05	2.0	2.0	2.5	2.1	2.0	2.1
2	2.05	2.0	2.0	2.4	2.1	2.0	2.1
3	2.05	1.8	2.0	2.3	2.1	2.0	2.1
4	3.0	2.0	2.4	2.3	2.1	2.0	2.1
5	2.5	2.0	2.2	2.2	2.1	2.0	2.0
6	2.3	2.1	2.1	2.3	2.1	1.9	2.0
7	2.3	2.0	2.1	2.2	2.2	1.9	2.0
8	2.2	2.0	2.1	2.2	2.2	1.9	2.0
9	2.2	2.0	2.1	2.3	2.1	1.9	2.0
10	2.1	2.0	2.1	2.3	2.1	1.9	2.0
11	2.1	2.1	2.1	2.2	2.1	1.9	3.0
12	2.1	2.0	2.1	2.2	2.0	1.9	2.1
13	2.1	2.0	2.05	2.2	2.1	1.8	2.0
14	2.3	2.0	2.4	2.2	2.1	1.8	2.0
15	2.3	2.0	2.6	2.5	2.0	1.8	2.0
16	2.2	1.9	2.5	2.4	2.0	1.8	.....
17	2.2	2.0	2.4	2.3	2.0	2.0	.....
18	2.2	2.0	2.3	2.2	2.0	2.0	.....
19	2.1	1.9	2.4	2.2	2.0	2.0	.....
20	2.1	1.9	2.3	2.2	2.0	2.5	.....
21	2.1	2.0	2.3	2.2	1.9	2.1	.....
22	2.1	2.0	2.3	2.2	1.9	2.2	.....
23	2.3	2.0	2.3	2.2	1.9	2.1	.....
24	2.3	1.8	2.3	2.1	2.0	2.0	.....
25	2.2	2.0	2.3	2.1	2.0	2.0	.....
26	2.1	2.0	2.3	2.2	2.0	2.1	.....
27	2.1	2.0	2.6	2.2	2.0	3.0	.....
28	2.2	2.0	2.5	2.1	2.0	2.0	.....
29	2.2	.....	2.5	2.1	2.0	2.2	.....
30	2.1	.....	2.4	2.1	2.0	2.1	.....
31	2.1	.....	2.5	.....	2.0	.....	.....

NOTE.—Discharge probably unaffected by ice.

Monthly discharge of Cooks Creek near Mount Crawford, Va., for 1905–6.

[Drainage area, 41 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
July	346	19	43.8	1.07	1.23
August	27	13	19.7	.480	.55
September	16	10	12.7	.310	.35
October	19	10	11.4	.278	.32
November	13	10	11.4	.278	.31
December	64	10	18.7	.456	.53

Monthly discharge of Cooks Creek near Mount Crawford, Va., for 1905 6—Continued.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1906.					
January	71	21	27.5	.671	.77
February	23	13	18.5	.451	.47
March	46	19	30.6	.746	.86
April	41	23	28.7	.700	.78
May	27	16	20.6	.502	.58
June	71	13	21.0	.512	.57
July 1-15	71	19	23.8	.580	.32

NOTE.—Values rated as follows: July, 1905, fair; August and December, 1905, good; September to November, 1905, approximate; 1906, good. Discharge determinations below 15 second-feet and above 60 second-feet, approximate. The rating used to determine the above values is virtually based on two measurements and hence is very uncertain.

ELK RUN AT ELKTON, VA.

This station was established June 28, 1905, in connection with the investigation of stream pollution in the Shenandoah Valley and was discontinued July 15, 1906. It was located at the highway bridge 500 feet south of the railroad station at Elkton, Va. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 80, and in Water-Supply Paper No. 192, where are given also the data for previous years.

Discharge measurements of Elk Run at Elkton, Va., in 1906.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
April 11	Robert Follansbee	2.78	15.7
June 14	Follansbee and Padgett	2.57	6.5

Daily gage height, in feet, of Elk Run at Elkton, Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	2.85	2.9	2.7	3.1	2.9	2.67	2.5
2	2.8	2.95	2.7	3.8	2.88	2.5	2.5
3	2.75	2.9	3.35	3.0	2.75	2.6	2.5
4	3.25	2.9	3.3	2.95	2.8	2.65	2.6
5	3.1	2.9	2.9	2.85	2.8	2.51	2.5
6	3.0	2.85	2.85	2.9	2.9	2.6	3.5
7	2.91	2.85	2.8	2.85	2.95	2.59	2.8
8	2.8	2.8	2.8	2.8	2.9	2.5	2.75
9	2.96	2.8	2.81	2.95	2.8	2.6	2.7
10	2.91	2.8	2.7	2.8	2.87	2.58	2.72
11	2.9	2.8	2.8	2.85	2.85	2.53	2.7
12	2.8	2.78	2.75	2.8	2.7	2.6	2.72
13	2.8	2.77	2.85	2.8	2.75	2.58	2.7
14	2.8	2.75	2.95	2.85	2.7	2.47	2.7
15	3.0	2.7	3.0	4.5	2.55	2.58	2.75
16	2.9	2.77	3.1	3.5	2.64	2.6	.....
17	2.85	2.7	3.0	3.2	2.6	2.6	.....
18	2.8	2.7	2.95	3.0	2.6	2.65	.....
19	2.8	2.8	2.9	2.95	2.6	2.7	.....
20	2.75	2.72	2.85	2.85	2.6	3.65	.....

Daily gage height, in feet, of Elk Run at Elkton, Va., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
21	2.75	2.7	2.9	2.9	2.55	2.9	.....
22	2.8	2.78	2.9	2.9	2.62	3.2	.....
23	3.0	2.77	2.85	2.85	2.6	2.9	.....
24	3.1	2.8	2.8	2.8	2.5	2.87	.....
25	3.0	2.75	2.7	2.8	2.6	2.82	.....
26	2.95	2.78	2.9	2.95	2.62	2.72	.....
27	3.0	2.75	2.85	3.0	2.5	2.63	.....
28	3.15	2.75	2.9	2.95	2.72	2.6	.....
29	2.95	.....	3.0	2.95	2.7	2.6	.....
30	3.0	.....	2.9	2.85	2.65	2.55	.....
31	2.9	.....	3.1	.....	2.7	.....	.....

NOTE.—Discharge affected only slightly by ice.

Daily discharge, in second-feet, of Elk Run at Elkton, Va., for 1905-6.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.							1905.						
1	14	8.5	8.5	6.5	9.5	9.5	17	9.5	10.5	5.5	10	9.5	7.5
2	14	8	7	6.5	9.5	9.5	18	9.5	8.5	5.5	9	9.5	7.5
3	11	8	7	6.5	9.5	9.5	19	8.5	9.5	5.5	9	9.5	9.5
4	11	7	7	6	9.5	9.5	20	8	8.5	15	9	10.5	32
5	11	7	8.5	6	9.5	9.5	21	8	8.5	8.5	10	9.5	46
6	11	7	7	6.5	9.5	9.5	22	10.5	9.5	7	10	8.5	11.5
7	11	7	5.5	6.5	9.5	9.5	23	7	8.5	7	10	8.5	9.5
8	11	9.5	5.5	6.5	12	8.5	24	7	23	7	10	8.5	9.5
9	9	8.5	5.5	8	9.5	8.5	25	7	28	6.5	12	8.5	11.5
10	9	7	5.5	8	9.5	9.5	26	7	19	6.5	12	8.5	9.5
11	9	10.5	6	27	9.5	9.5	27	7	19	6.5	9.5	8.5	11.5
12	57	10.5	5.5	14.5	9.5	8.5	28	8.5	12.5	6.5	9.5	8.5	11.5
13	28	29	6	10	9.5	8.5	29	8.5	10	6.5	9.5	8.5	17
14	19	85	6	8	12	8.5	30	8.5	10	6.5	9.5	8.5	15.5
15	12.5	19.5	6	8	9.5	7.5	31	8.5	8.5	.....	9.5	.....	14
16	9.5	13	5.5	8	9.5	7.5							

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1906.							
1	13	15.5	11.5	29	17.5	9	6
2	11.5	18	11.5	89	17	6.5	6
3	10.5	16.5	42.5	24	13	8	6
4	29	16.5	38.5	21.5	14.5	8	7
5	21.5	16.5	17.5	17.5	14.5	6	6
6	17.5	15	15.5	19.5	17.5	7	44
7	14.5	15	14	17.5	19.5	7	11
8	11.5	13.5	15	16	16.5	6	11
9	16	13.5	15	21.5	13.5	7	9
10	14.5	13.5	12	16	15.5	7	9
11	14	13.5	15	17.5	15	6	9
12	11.5	13	13.5	16	13	7	9
13	11.5	12.5	16.5	16	12	7	9
14	11.5	12	20.5	17.5	13	5.5	9
15	17.5	11	22.5	132	8	6.5	10
16	15.5	12.5	27.5	58.5	9.5	7	.....
17	14	11	22.5	35.5	8.5	7	.....
18	12.5	11	20.5	24	8.5	7.5	.....
19	12.5	14	18.5	21.5	8.5	8.5	.....
20	11	12	16.5	16.5	8.5	54	.....
21	11	11.5	18.5	18.5	7.5	13	.....
22	12.5	13.5	18.5	18.5	9	24	.....
23	19	13	16.5	16.5	8.5	13	.....
24	23	14	15	15	7	12	.....
25	19	12.5	13	15	8.5	11	.....
26	17	13.5	19.5	20.5	8	9	.....
27	19	12.5	17.5	23	6.5	7.5	.....
28	25.5	12.5	19.5	20.5	10	7	.....
29	17	.....	24	19.5	9.5	7	.....
30	19	.....	19.5	16	8	6.5	.....
31	15.5	.....	29	.....	9.5	.....	.....

NOTE.—Discharge obtained by indirect method for shifting channel.

Monthly discharge of Elk Run at Elkton, Va., for 1905–6.

[Drainage area, 15.8 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
July	57	7.0	11.9	0.753	0.87
August	85	7.0	14.1	.892	1.03
September	15	5.5	6.7	.426	.48
October	27	6.0	9.4	.594	.68
November	12	8.5	9.4	.595	.66
December	46	7.5	11.8	.747	.86
1906.					
January	29	10	15.8	1.00	1.15
February	18	11	13.5	.854	.89
March	42	11	19.3	1.22	1.41
April	132	15	27.0	1.71	1.91
May	20	6.5	11.5	.728	.84
June	54	5.5	9.9	.627	.70
July 1–15	44	6.0	10.7	.677	.38

NOTE.—Values for 1905 and 1906 are approximate, owing to shifting channel and insufficient discharge measurements.

HAWKSBILL CREEK NEAR LURAY, VA.

This station was established June 27, 1905, in connection with the investigation of stream pollution in the Shenandoah River Valley, and was discontinued July 15, 1906. It is located a short distance above the mouth of Dry Run, 1½ miles north of Luray, Va. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 81, and in Water-Supply Paper No. 192, where are given also references to publications that contain data for previous years.

Discharge measurements of Hawksbill Creek near Luray, Va., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 12	Robert Follansbee	39	46	1.86	75
June 15 [a]	Follansbee and Padgett	20	17	1.50	36

[a] Wading below foot bridge.

Daily gage height, in feet, of Hawksbill Creek near Luray, Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	2.0	1.9	1.55	2.3	1.9	1.6	1.6
2	1.9	1.9	1.55	2.2	1.85	1.6	1.55
3	3.3	1.9	1.8	2.1	1.85	1.55	1.55
4	2.7	1.85	2.0	2.05	1.85	1.55	1.55
5	2.45	1.85	1.95	2.0	1.8	1.5	1.55
6	2.25	1.75	1.85	1.95	1.75	1.5	1.5
7	2.2	1.7	1.85	1.95	1.75	1.5	1.5
8	2.1	1.7	1.85	1.9	1.75	1.5	1.5
9	2.0	1.7	1.8	1.9	1.75	1.5	1.5
10	2.05	1.65	1.8	1.95	1.75	2.0	1.5
11	2.0	1.65	1.75	1.9	1.75	1.8	1.8
12	1.9	1.65	1.7	1.9	1.7	1.6	1.6
13	1.8	1.65	1.7	1.8	1.7	1.55	1.55
14	1.8	1.7	1.7	1.8	1.65	1.55	1.55
15	1.8	1.65	1.75	3.35	1.65	2.65	1.55

Daily gage height, in feet, of Hawksbill Creek near Luray, Va., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
16	1.8	1.6	1.8	3.05	1.65	1.95	.....
17	1.75	1.6	1.75	2.55	1.65	2.5	.....
18	1.75	1.6	1.75	2.35	1.6	1.8	.....
19	1.75	1.55	1.85	2.25	1.6	1.6	.....
20	1.75	1.55	1.9	2.2	1.6	1.6	.....
21	1.7	1.6	1.9	2.1	1.6	2.45	.....
22	1.65	1.55	1.9	2.0	1.55	1.75	.....
23	1.75	1.55	1.9	1.85	1.5	1.7	.....
24	1.75	1.5	1.9	1.85	1.5	1.7	.....
25	1.8	1.55	1.9	1.85	1.5	1.7	.....
26	1.8	1.55	1.9	2.1	1.5	1.8	.....
27	1.9	1.55	2.15	2.05	1.5	1.8	.....
28	1.9	1.55	2.4	2.0	1.6	1.75	.....
29	1.9	.....	2.35	1.9	1.6	1.7	.....
30	1.9	.....	2.3	1.9	1.55	1.65	.....
31	1.9	.....	2.4	.....	1.5	.....	.....

NOTE.—Discharge probably unaffected by ice.

Rating table for Hawksbill Creek near Luray, Va., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	24	1.90	83	2.50	196	3.10	355
1.40	30	2.00	98	2.60	220	3.20	384
1.50	37	2.10	115	2.70	245	3.30	414
1.60	46	2.20	133	2.80	271	3.40	445
1.70	57	2.30	152	2.90	298		
1.80	69	2.40	173	3.00	326		

NOTE.—The above table is applicable only for open-channel conditions. It is based on five discharge measurements made during 1905 and 1906. It is fairly well defined between gage heights 1.4 feet and 2 feet.

Monthly discharge of Hawksbill Creek near Luray, Va., for 1905–6.

[Drainage area, 52 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
June 27-31	63	46	54.5	1.05	0.16
July	46	30	36.1	.694	.80
August	63	27	32.6	.627	.72
September	37	24	27.5	.529	.59
October	46	27	30.0	.577	.66
November	34	27	30.0	.577	.64
December	298	30	81.7	1.57	1.81
1906.					
January	414	52	100	1.92	2.21
February	83	37	53.9	1.04	1.08
March	173	42	85.2	1.64	1.89
April	430	69	123	2.37	2.64
May	83	37	53.6	1.03	1.19
June	232	37	68.8	1.32	1.47
July 1-15	69	37	42.7	.821	.458

NOTE.—Values rated as follows: June to August, 1905, February, March, May to July, 1906, excellent; remainder of 1905 and 1906, good.

NORTH FORK OF SHENANDOAH RIVER NEAR RIVERTON, VA.

This station was established June 26, 1899, and was discontinued July 14, 1906. It is located about 2 miles above Riverton, Va., on the farm owned by L. W. Burke. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 83, and in Water-Supply Paper No. 192, where are given also the data for previous years.

The following discharge measurement was made April 13, 1906:

Width, 230 feet; area, 638 square feet; gage height, 5.60 feet; discharge, 969 second-feet.

Daily gage height, in feet, of North Fork of Shenandoah River near Riverton, Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	5.7	5.3	4.55	7.9	5.65	4.62	5.05
2	5.45	5.2	4.5	7.1	5.5	4.7	4.88
3	5.4	5.1	4.75	6.7	5.4	4.58	4.85
4	8.6	5.5	6.45	6.32	5.35	4.52	6.12
5	7.75	5.0	6.55	6.1	5.25	4.65	5.52
6	6.83	4.98	5.9	5.92	5.32	4.62	5.2
7	6.2	5.15	5.55	5.75	5.32	4.55	4.95
8	5.85	5.6	5.45	5.6	5.48	4.75	4.82
9	5.58	5.5	5.35	5.52	5.45	4.62	4.7
10	5.35	5.25	5.25	6.1	5.3	4.6	4.6
11	5.37	5.45	5.15	5.95	5.22	4.85	4.6
12	5.27	4.9	5.0	5.75	5.2	4.78	4.6
13	5.25	4.68	5.0	5.62	5.05	4.65	4.65
14	5.3	4.6	5.0	5.28	5.0	4.58	4.62
15	5.4	4.68	5.05	6.4	4.9	5.05	.....
16	5.48	4.65	5.2	6.98	4.88	5.25	.....
17	5.4	4.8	5.45	6.4	4.82	5.5	.....
18	5.38	4.55	5.58	6.05	4.8	5.85	.....
19	5.33	4.52	5.8	5.88	4.8	5.9	.....
20	5.27	4.6	5.9	5.7	4.72	5.65	.....
21	5.2	4.6	5.95	5.58	4.62	6.85	.....
22	5.1	4.6	6.2	5.48	4.6	7.25	.....
23	5.05	4.6	6.55	5.4	4.6	6.6	.....
24	5.7	4.6	6.45	5.28	4.55	5.8	.....
25	5.9	4.53	6.2	5.2	4.55	5.55	.....
26	5.55	4.55	6.1	5.2	4.52	5.3	.....
27	5.33	4.52	7.5	7.48	4.52	6.1	.....
28	5.3	4.58	9.4	6.7	5.08	6.2	.....
29	5.37	.....	8.45	6.15	4.9	5.7	.....
30	5.43	.....	8.35	5.85	4.75	5.35	.....
31	5.35	.....	8.1	.....	4.65	.....	.....

NOTE.—Backwater due to ice conditions February 4, 7–11, 17.

Rating table for North Fork of Shenandoah River, near Riverton, Va., from August 16, 1904, to July 14, 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.50	275	5.60	925	6.70	1,870	7.80	3,080
4.60	325	5.70	1,000	6.80	1,970	7.90	3,210
4.70	375	5.80	1,075	6.90	2,070	8.00	3,340
4.80	425	5.90	1,155	7.00	2,170	8.20	3,600
4.90	480	6.00	1,235	7.10	2,270	8.40	3,880
5.00	535	6.10	1,320	7.20	2,380	8.60	4,160
5.10	595	6.20	1,405	7.30	2,490	8.80	4,450
5.20	655	6.30	1,495	7.40	2,600	9.00	4,750
5.30	720	6.40	1,585	7.50	2,720		
5.40	785	6.50	1,680	7.60	2,840		
5.50	855	6.60	1,775	7.70	2,960		

NOTE.—The above table is applicable only for open-channel conditions. It is based on seven discharge measurements made during 1904–1906 after dam at Riverton was raised 2 feet. It is well defined between gage heights 4 feet and 5.5 feet. During August, 1904, the dam was raised 2 feet. The exact date is uncertain, but the table is assumed to apply from August 16, 1904.

Monthly discharge of North Fork of Shenandoah River near Riverton, Va., for 1906.

[Drainage area, 1,040 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	4,160	565	1,040	0.996	1.15
February	720	285	418	.402	.42
March	5,350	275	1,420	1.37	1.58
April	3,210	655	1,320	1.27	1.42
May	962	285	545	.524	.60
June	2,440	285	787	.757	.84
July 1-14	1,340	325	523	.503	.26

NOTE.—The discharge was estimated for February 4, 7-11, 17, when the gage was affected by backwater. Values are rated as follows: January to March, good; April to July, excellent.

PASSAGE CREEK AT BUCKTON, VA.

This station was established October 26, 1905, and was discontinued July 15, 1906. It is located about 700 feet above the mouth of the creek, at the trestle of the Southern Railway at Buckton, which is a siding 1 mile east of Waterlick, Va. Passage Creek is a tributary of North Fork of Shenandoah River. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 85, and in Water-Supply Paper No. 192, where are given also the data for previous years.

Discharge measurements of Passage Creek at Buckton, Va., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 13	Robert Follansbee	47	51	1.40	91
June 16	do	48	66	1.72	132

Daily gage height, in feet, of Passage Creek at Buckton, Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	1.4	1.2	1.1	2.6	1.3	0.85	1.3
2	1.35	1.25	1.0	2.2	1.3	.95	1.2
3	1.3	1.3	1.1	1.9	1.3	.9	1.2
4	3.4	1.3	3.1	1.8	1.25	.85	1.2
5	2.0	1.3	2.2	1.7	1.25	.9	1.1
6	1.8	1.4	1.6	1.6	1.25	1.1	1.0
7	1.5	1.4	1.5	1.6	1.25	1.0	.9
8	1.5	1.6	1.5	1.5	1.3	.9	.9
9	1.5	1.7	1.5	1.3	1.25	.85	.85
10	1.55	1.6	1.4	1.9	1.2	.85	.85
11	1.55	1.5	1.3	1.6	1.2	.85	.85
12	1.5	1.5	1.3	1.5	1.2	1.1	.8
13	1.4	1.2	1.3	1.4	1.2	1.0	1.0
14	1.4	1.1	1.3	1.4	1.2	.9	.85
15	1.5	1.1	1.4	2.5	1.1	.9	.85
16	1.45	1.2	1.4	2.4	1.1	1.6	.....
17	1.4	1.15	1.35	2.0	1.0	2.55	.....
18	1.3	1.15	1.4	1.85	1.0	3.2	.....
19	1.3	1.1	1.6	1.7	1.0	2.2	.....
20	1.3	1.1	1.5	1.6	1.0	2.1	.....

Daily gage height, in feet, of Passage Creek at Buckton, Va., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
21	1.2	1.0	1.6	1.55	1.0	2.4	.....
22	1.2	1.0	1.8	1.5	.95	2.52	.....
23	1.2	1.0	2.2	1.4	.9	2.1	.....
24	1.25	1.0	2.1	1.4	.9	1.95	.....
25	1.2	1.0	2.1	1.4	.8	1.9	.....
26	1.2	1.0	2.1	1.4	.75	1.7	.....
27	1.2	1.0	2.6	1.65	.8	2.6	.....
28	1.25	1.1	3.4	1.5	.95	1.7	.....
29	1.2	.....	3.4	1.4	1.0	1.6	.....
30	1.2	.....	3.3	1.35	.9	1.4	.....
31	1.2	.....	2.6	.....	.85	.....	.....

NOTE.—Ice conditions February 4-13.

MONOCACY RIVER NEAR FREDERICK, MD.

This station was established August 4, 1896. It is located at the county bridge on the toll road leading from Frederick to Mount Pleasant, Md. It is 4 miles northeast of Frederick, about 2,000 feet above the mouth of Israel Creek, and 3,000 feet below the mouth of Tuscarora Creek. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 86, and in Water-Supply Paper No. 192, where are given also the data for previous years.

The following discharge measurement was made May 31, 1906:

Area, 324 square feet; gage height, 4.70 feet; discharge, 328 second-feet.

Daily gage height, in feet, of Monocacy River near Frederick, Md., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.2	4.9	5.3	9.7	5.4	4.7	4.5	4.5	5.5	4.3	5.6	4.5
2	5.7	4.8	5.5	7.8	5.4	4.7	4.5	9.1	5.2	4.3	5.5	4.5
3	7.5	4.5	9.1	7.4	5.3	4.6	4.5	16.1	5.1	4.3	5.3	4.5
4	18.35	4.5	16.65	6.9	5.3	4.5	5.3	10.1	4.9	4.8	5.2	4.5
5	12.6	5.1	9.1	6.5	5.2	4.4	5.1	5.5	4.9	7.1	5.1	4.5
6	7.6	5.0	6.9	6.3	5.3	4.4	4.6	5.3	4.8	6.1	5.0	4.7
7	6.7	4.9	6.5	6.2	5.3	4.4	4.6	5.1	4.7	5.8	4.9	4.8
8	6.6	4.8	6.4	6.1	5.3	4.4	4.5	4.9	4.6	4.9	4.8	4.8
9	6.2	5.2	6.3	7.5	5.2	4.4	4.5	4.8	4.6	4.7	4.8	4.7
10	5.9	5.1	6.1	16.8	5.0	5.5	4.4	4.8	4.5	4.6	4.8	5.9
11	5.7	5.0	5.9	9.1	5.0	5.1	4.4	6.1	4.4	4.5	4.8	6.8
12	6.9	4.9	5.8	8.5	4.9	4.5	4.9	5.1	4.4	4.4	4.7	6.4
13	6.7	4.8	5.8	7.1	4.9	4.5	4.5	6.1	4.4	4.3	4.7	5.3
14	6.2	5.9	5.8	6.9	4.9	4.4	4.4	4.8	4.4	4.3	4.7	5.2
15	6.5	8.1	5.8	21.8	4.7	4.4	4.4	4.7	4.4	4.3	4.8	5.2
16	7.1	5.4	5.8	15.5	4.8	4.5	4.4	4.6	4.4	4.3	4.8	7.6
17	6.9	4.9	5.7	10.2	4.8	4.6	4.5	4.6	4.4	4.3	4.8	9.8
18	6.2	4.8	5.7	8.1	4.7	7.1	4.5	4.5	4.4	4.3	4.9	12.1
19	5.9	5.0	5.6	7.5	4.7	9.7	4.4	8.5	4.4	9.5	5.2	8.5
20	5.7	5.0	5.6	7.1	4.5	9.5	4.4	7.5	4.4	13.2	5.5	6.5
21	5.7	5.4	5.5	6.7	4.5	10.5	4.3	6.5	4.8	9.5	5.1	9.5
22	5.7	9.4	5.5	6.4	4.5	10.7	4.4	5.4	4.6	11.5	5.0	7.5
23	5.6	6.5	5.5	6.3	4.5	6.7	4.8	7.35	4.4	8.5	4.9	6.9
24	5.6	6.1	5.6	6.1	4.5	6.1	5.1	6.5	4.4	7.5	4.8	5.8
25	5.6	6.7	5.6	5.9	4.4	5.9	4.8	7.5	4.4	8.5	4.7	5.7
26	5.5	6.9	5.5	5.8	4.5	5.8	4.6	7.8	4.3	8.1	4.6	5.6
27	5.5	5.9	9.0	5.7	4.5	5.1	4.4	11.0	4.3	7.5	4.6	7.8
28	5.55	6.1	17.45	5.5	5.6	4.9	4.35	9.8	4.3	6.7	4.6	6.9
29	5.3	.....	12.5	5.4	5.1	4.8	4.5	7.5	4.3	6.2	4.5	5.8
30	5.2	.....	10.5	5.4	4.8	4.7	4.3	6.1	4.3	5.8	4.5	5.7
31	5.1	.....	9.6	.....	4.7	.....	4.3	5.8	.....	5.7	.....	8.4

NOTE.—Ice conditions February 6, 7, and 9.

Rating table for Monocacy River near Frederick, Md., for 1904–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.80	80	5.20	538	6.60	1,390	9.00	3,525
3.90	99	5.30	584	6.70	1,465	9.20	3,715
4.00	120	5.40	632	6.80	1,545	9.40	3,905
4.10	144	5.50	682	6.90	1,625	9.60	4,100
4.20	170	5.60	734	7.00	1,705	9.80	4,300
4.30	198	5.70	789	7.20	1,875	10.00	4,500
4.40	228	5.80	846	7.40	2,045	11.00	5,500
4.50	260	5.90	906	7.60	2,220	12.00	6,500
4.60	294	6.00	969	7.80	2,400	13.00	7,550
4.70	330	6.10	1,034	8.00	2,580	14.00	8,600
4.80	368	6.20	1,102	8.20	2,765		
4.90	408	6.30	1,172	8.40	2,955		
5.00	450	6.40	1,242	8.60	3,145		
5.10	493	6.50	1,315	8.80	3,335		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1900 to 1906. It is fairly well defined between gage heights 4 feet and 10 feet. Above 12 feet gage height the rating curve is a tangent, the difference being 105 per tenth.

Monthly discharge of Monocacy River near Frederick, Md., for 1906.

[Drainage area, 660 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	13,200	493	1,660	2.51	2.89
February	3,900	260	824	1.25	1.30
March	12,200	584	2,280	3.45	3.98
April	16,800	632	2,880	4.36	4.86
May	734	228	422	.639	.74
June	5,200	228	1,040	1.57	1.75
July	584	198	284	.430	.50
August	10,800	260	1,780	2.70	3.11
September	682	198	290	.439	.49
October	7,700	198	1,490	2.25	2.59
November	734	260	418	.633	.71
December	6,600	260	1,430	2.17	2.50
The year	16,800	198	1,230	1.87	25.42

NOTE.—Values for entire year are excellent.

The following table gives the horsepower (80 per cent efficiency) per foot of fall that may be developed at different rates of discharge, and shows the number of days on which the flow and the corresponding horsepower were, respectively, less than the amounts given in the columns for "discharge" and "horsepower."

Discharge and horsepower table for Monocacy River at Frederick, Md., from 1896 to 1906.

Discharge in second-feet.	Horsepower (80 per cent efficiency), per foot fall.	Number of days of deficient flow.										
		1896.[a]	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
55	5	.....	.....	.....	.....	4	.....	.....	.....	.....	.....	.....
66	6	.....	.....	.....	.....	16	.....	10	.....	.....	.....	.....
88	8	16	.....	.....	4	63	.....	22	.....	21	.....	.....
110	10	32	6	22	29	89	.....	29	.....	27	.....	.....
132	12	74	19	37	56	119	.....	38	.....	78	.....	.....
154	14	98	45	48	75	142	1	48	.....	85	2	.....
176	16	114	56	58	100	163	25	72	4	123	17	.....
198	18	115	63	59	100	165	25	72	4	123	17	.....
220	20	128	86	68	118	174	74	94	15	129	36	18
275	25	136	115	99	149	196	131	115	56	152	78	82
330	30	142	130	116	163	213	155	147	78	187	106	96
385	35	142	149	123	169	224	165	152	94	216	151	138
440	40	145	171	138	187	244	204	170	128	240	169	154
495	45	147	192	157	206	254	216	176	130	259	195	175
550	50	147	199	169	213	265	229	185	138	269	205	184
660	60	148	222	206	231	275	243	207	154	285	220	202
770	70	149	243	234	243	299	264	217	173	297	237	226

[a] August 4 to December 31.

NOTE.—During the period covered by the above table the minimum flow was 49 second-feet, giving 4.5 horsepower per foot of fall for four consecutive days.

JAMES RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The headwaters of the James lie in the high mountains in the extreme western part of Virginia. The river is formed by the confluence of Jackson and Cowpasture rivers in the northern part of Botetourt County, Va.; thence it flows eastward across the State and empties into Chesapeake Bay through Hampton Roads. The total length of the river is about 335 miles and its drainage area is about 9,700 square miles. The river and all its tributaries lie wholly within the State of Virginia.

The topography of the basin is varied in character, changing from the mountainous section in the upper part to low, flat, and often swampy areas as tide water is approached. Jackson and Cowpasture rivers flow in narrow valleys between steep hills, over beds of sand and gravel, with rock ledges in places, and are bordered with fertile bottom lands. In this portion of the basin the water collects quickly, causing rapid rises in the river below.

Near Clifton Forge and again near Balcony Falls the James flows through ridges of the Alleghenies, with sharp falls over beds of solid rock. At other points similar though less pronounced falls and rapids occur as the river cuts through the lesser foothills. Between these mountainous or hilly sections the stream winds through broad and fertile valleys over beds of sand and gravel, with gentle slope. The fall line is crossed at Richmond.

Many dams have been built in the James, generally for diverting water into the old James and Kanawha Canal, which followed the river from Richmond to Buchanan and was at one time utilized throughout that entire distance. It has now been abandoned, however, and its right of way is owned and for considerable distances occupied by the Chesapeake and Ohio Railway. The use of the dams was abandoned with the canal, and though many of them are in good repair they have not been improved for power purposes. The principal utilized power is at Richmond. On October 19, 1904, a measurement of the James and Kanawha Canal was made about 5 miles above Richmond, Va., at a bridge opposite the 5-mile post of the Chesapeake and Ohio Railway. Area, 318 square feet; discharge, 556 second-feet.

The fluctuations in stage are great. The records of the Cartersville station, which extend over a period of eight years, show a range in gage height of nearly 25 feet. The discharge has varied between 97,800 and 600 second-feet.

In 1897 a reconnaissance survey of James River was made under the direction of D. C. Humphreys, professor of civil engineering of Washington and Lee University. This survey covered the portion of the river between Clifton Forge and Richmond and a part of North River, and consisted in determining the profile, which was done by using the profile of the Chesapeake and Ohio Railway as a base and tying on to the water surface at each dam and at intermediate points not more than 5 miles apart. Notes were made in regard to the condition of the dams and measurements of flow were made on all of the more important tributaries. The results of this reconnaissance were published in the Nineteenth Annual Report of the United States Geological Survey, Part IV, pages 162–173, and in Bulletin No. 3 of the Geological Survey of Virginia, Thomas L. Watson, geologist in charge, Blacksburg, Va.

Gages were established on James River in 1893 by F. B. Isaacs, engineer for water power of the Chesapeake and Ohio Railway Company, at Ninemile Locks, Columbia, Scottsville, Lynchburg, Balcony Falls, Buchanan, Eagle Mountain, and Clifton Forge. Records of heights of water at these points were made twice daily from 1893 to 1897 and freshet reports were obtained for these years. The gages were not referred to any fixed datum, but the zero of each gage was set at what was considered ordinary low water in the river. During the latter part of 1899 records were resumed, except at Scottsville, Balcony Falls, and Eagle Mountain, where the gages have been abandoned.

At Boshers dam, 9 miles above Richmond, is a gage where the height of water is recorded twice daily, showing the supposed head on the crest of the dam. The crest, however, is so irregular that

the coefficient of discharge has not been ascertained. Another complication exists in the fact that water is deflected into a canal, the quantity not being known.

The United States Weather Bureau maintains river stations on the James at Lynchburg, Columbia, and Richmond, Va.

JAMES RIVER AT BUCHANAN, VA.

This station was established August 18, 1895, and was discontinued July 15, 1906. It is located at the iron highway bridge near the Chesapeake and Ohio Railway station and one-half mile from the Norfolk and Western Railway station. It is about 20 miles from the mouth of North River and one-half mile above the mouth of Purgatory Creek. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 91, where are given also references to publications that contain data for previous years.

The following discharge measurement was made June 12, 1906:

Width, 319 feet; area, 1,010 square feet; gage height, 2.31 feet; discharge, 727 second-feet.

Daily gage height, in feet, of James River at Buchanan, Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	3.64	4.13	2.45	6.24	3.2	2.7	2.25
3	3.42	3.88	2.35	5.42	3.1	2.61	2.21
3	3.39	3.56	2.55	4.95	3.14	2.59	2.25
4	7.9	3.42	4.21	4.42	2.96	2.4	4.22
5	7.08	3.34	5.39	4.35	3.02	2.31	2.96
6	5.40	3.2	4.22	4.0	3.45	2.72	2.72
7	4.72	3.19	3.91	4.05	3.55	2.64	2.45
8	4.18	3.09	3.55	3.84	3.4	2.52	2.3
9	3.93	2.9	3.52	3.8	3.36	2.51	2.26
10	3.55	2.94	3.28	4.28	3.12	2.34	2.2
11	3.39	2.93	3.24	4.92	3.1	2.3	2.19
12	3.33	2.7	3.01	4.46	2.94	2.34	2.12
13	3.39	2.77	3.01	4.25	2.91	2.3	2.22
14	3.55	2.75	2.85	3.9	2.7	2.45	2.31
15	3.55	2.65	3.38	4.48	2.78	2.4	2.32
16	3.81	2.72	7.00	5.5	2.65	2.4	.....
17	3.86	2.66	5.9	5.01	2.8	2.35	.....
18	3.79	2.49	4.83	4.4	2.9	2.55	.....
19	3.62	2.5	4.50	4.25	2.96	2.5	.....
20	3.41	2.5	4.67	3.92	2.76	4.12	.....
21	3.35	2.4	4.89	3.85	2.78	4.75	.....
22	3.46	2.5	4.63	3.6	2.6	3.96	.....
23	9.41	2.52	4.65	3.59	2.66	3.58	.....
24	9.16	2.45	4.28	3.4	2.49	3.16	.....
25	6.34	2.55	4.23	3.38	2.5	2.92	.....
26	5.4	2.53	3.88	3.12	2.36	2.79	.....
27	4.86	2.43	5.4	3.22	2.68	2.6	.....
28	4.83	2.5	7.88	3.1	2.75	2.6	.....
29	5.0	.....	7.14	3.2	2.8	2.59	.....
30	4.6	.....	6.16	3.1	2.9	2.51	.....
31	4.37	.....	6.46	.....	2.94	.....	.....

NOTE.—Discharge probably unaffected by ice.

Rating table for James River at Buchanan, Va., for 1898–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	505	3.30	1,815	4.50	4,025	6.40	8,495
2.20	575	3.40	1,965	4.60	4,235	6.60	9,030
2.30	655	3.50	2,125	4.70	4,450	6.80	9,575
2.40	740	3.60	2,290	4.80	4,665	7.00	10,130
2.50	835	3.70	2,460	4.90	4,885	7.20	10,700
2.60	935	3.80	2,640	5.00	5,105	7.40	11,290
2.70	1,040	3.90	2,825	5.20	5,555	7.60	11,900
2.80	1,155	4.00	3,015	5.40	6,015	7.80	12,520
2.90	1,275	4.10	3,210	5.60	6,485	8.00	13,140
3.00	1,400	4.20	3,410	5.80	6,965	9.00	16,470
3.10	1,530	4.30	3,610	6.00	7,460	10.00	20,300
3.20	1,670	4.40	3,815	6.20	7,970		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 17 discharge measurements made during 1901-1906. It is well defined between gage heights 1.8 feet and 4.5 feet. From 4.5 to 8.5 feet it is determined by two measurements made in 1901. Above gage height 8.5 feet it is determined by the product of the area and velocity curves, but these are somewhat uncertain. A rock control below the station causes the discharge measurements to plot on a fairly permanent curve.

Monthly discharge of James River at Buchanan, Va., for 1906.

[Drainage area, 2,060 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	18,000	1,860	4,750	2.31	2.66
February	3,270	740	1,300	.631	.66
March	12,800	698	4,250	2.06	2.38
April	8,070	1,530	3,390	1.65	1.84
May	2,210	706	1,310	.636	.73
June	4,560	655	1,180	.573	.64
July 1-15	3,450	519	888	.431	.24

NOTE.—Values for 1906 are excellent.

The following table gives the horsepower (80 per cent efficiency) per foot of fall that may be developed at different rates of discharge and shows the number of days on which the flow and the corresponding horsepower were respectively less than the amounts given in the columns for "discharge" and "horsepower."

Discharge and horsepower table for James River at Buchanan, Va., from 1895 to 1906.

Discharge in second-feet.	Horsepower (80 per cent efficiency) per foot fall.	Number of days of deficient flow.											
		1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
275	25	.....	[a] 2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
330	30	.....	[a] 8	25	6	71	16	.....	.....	.....	16	.....	.....
385	35	11	[a] 13	44	9	112	30	.....	18	.....	71	8	.....
440	40	59	[a] 13	67	9	112	31	.....	18	.....	105	19	.....
495	45	65	35	84	12	134	46	9	50	.....	126	70	.....
550	50	81	54	101	22	153	72	20	84	40	136	86	1
660	60	119	81	119	45	171	107	42	119	95	160	120	11
770	70	.....	105	146	52	178	125	52	139	115	181	146	24
880	80	.....	142	182	88	184	144	70	154	128	199	166	41
990	90	.....	165	191	102	194	163	89	166	138	213	187	52
1,100	100	.....	205	209	136	196	176	103	176	154	220	200	63
1,320	120	.....	235	238	175	202	207	132	205	172	234	222	80
1,540	140	.....	262	256	195	214	234	154	224	187	242	236	92

[a] In 1896 a discharge of less than 495 second-feet occurred only in April and May. As the determination for these months are known to be of doubtful value, they should be disregarded altogether in any power estimates.

NOTE.—The minimum discharge from 1895 to 1906 was 275 second-feet, giving 25 horsepower per foot of fall, on eleven consecutive days in October, 1899, and on three consecutive days in August and in September, 1900.

JAMES RIVER AT HOLCOMB ROCK, VA.

This station was established by the Willson Aluminum Company, of Holcomb Rock, Va., in 1899, in connection with measurements to determine the horsepower available at that point. During 1899 the records were fragmentary, but at the beginning of 1900 daily records were taken, which have been furnished to the United States Geological Survey through the courtesy of the general manager of the company. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 93, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of James River, at Holcomb Rock, Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.9	2.9	1.3	5.75	1.75	1.6	1.4	1.5	3.8	3.45	2.25	1.85
2	3.75	2.75	1.3	4.9	1.8	1.7	1.5	1.4	2.65	3.8	2.2	1.8
3	3.0	2.45	1.7	4.05	1.75	1.35	1.05	1.3	2.45	5.85	2.1	1.7
4	2.5	2.0	4.2	3.6	1.7	1.3	2.05	1.3	2.25	9.55	1.95	1.7
5	2.4	2.1	4.8	3.15	1.7	1.3	1.85	1.0	2.05	9.65	1.85	1.65
6	2.55	2.1	3.7	2.95	1.55	1.5	1.55	1.5	1.9	6.6	1.7	1.7
7	3.0	2.0	2.9	2.75	2.25	1.55	1.45	2.0	1.8	5.65	1.7	1.65
8	3.3	1.75	2.55	2.55	2.1	1.35	1.1	2.35	1.7	4.65	1.7	1.6
9	2.95	1.7	2.35	2.6	2.05	1.3	1.15	2.1	1.6	3.85	1.7	1.45
10	2.55	1.7	2.3	3.15	2.0	1.15	1.2	2.05	1.55	3.2	1.65	1.5
11	2.2	1.7	2.0	3.75	1.85	1.25	1.2	1.7	1.5	2.7	1.55	1.6
12	2.1	1.55	2.0	3.4	1.8	1.3	1.2	1.6	1.55	2.45	1.65	1.55
13	2.1	1.6	1.9	3.1	1.55	1.3	1.1	1.7	1.85	2.15	1.7	1.5
14	2.4	1.55	1.85	2.7	1.6	1.4	1.2	2.15	2.25	2.0	1.65	1.4
15	2.4	1.55	2.25	3.3	1.55	1.3	1.1	3.45	1.8	1.95	1.6	1.4
16	2.55	1.5	5.4	4.6	1.5	1.3	1.35	4.2	1.5	1.85	1.6	1.45
17	2.55	1.5	5.15	4.4	1.5	1.1	1.3	4.05	1.35	1.8	1.6	1.6
18	2.5	1.25	3.7	3.65	1.6	1.4	1.2	3.6	1.35	3.4	1.55	4.7
19	2.5	1.5	3.6	3.2	1.65	1.5	1.25	3.0	1.4	13.4	3.95	6.8
20	2.3	1.45	3.85	2.9	1.6	4.75	1.3	3.2	1.4	19.0	9.85	4.35
21	2.0	1.35	3.9	2.65	1.5	4.5	1.1	3.2	1.3	12.3	7.85	3.7
22	2.05	1.4	3.85	2.55	1.4	3.55	1.2	2.9	1.4	8.1	5.3	3.55
23	5.85	1.3	3.4	2.4	1.3	2.65	1.7	2.75	1.6	6.3	4.2	3.35
24	9.85	1.4	3.3	2.25	1.3	2.05	1.4	2.8	1.9	5.45	3.35	2.8
25	6.3	1.1	2.95	2.1	1.3	1.95	1.3	2.9	1.65	4.4	2.85	2.55
26	4.7	1.35	2.9	2.1	1.3	1.7	1.3	2.8	1.55	3.8	2.65	2.35
27	4.0	1.35	3.65	2.0	1.3	2.1	1.3	2.75	1.4	3.4	2.45	2.2
28	3.75	1.3	7.1	2.0	1.5	1.65	1.3	4.75	1.6	3.2	2.25	2.2
29	4.1	.....	6.5	1.85	1.6	1.85	1.5	5.9	2.15	2.85	2.05	2.2
30	3.8	.....	5.8	1.75	1.8	1.6	2.05	4.6	2.25	2.5	1.85	2.1
31	3.35	.....	5.85	.....	1.7	.....	1.7	3.85	.....	2.35	.....	3.1

JAMES RIVER AT CARTERSVILLE, VA.

This station was established January 1, 1899. It is located at the highway bridge crossing the James between Pemberton and Cartersville, 300 yards from the railroad station, and 50 miles above Richmond, Va. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 94, where are given also references to publications that contain data for previous years.

The following discharge measurement was made June 7, 1906:

Width, 690 feet; area, 2,100 square feet; gage height, 2.22 feet; discharge, 3,400 second-feet.

Daily gage height, in feet, of James River at Cartersville, Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.98	5.37	2.22	8.62	2.9	2.6	3.0	2.98	6.03	4.88	3.95	3.1
2	4.38	4.3	2.4	8.2	2.88	4.85	2.15	3.75	5.38	3.50	3.65	2.95
3	3.85	4.2	2.52	6.95	2.8	3.62	1.9	3.6	4.55	5.15	3.45	2.8
4	17.0	3.38	10.1	6.05	2.8	2.59	1.85	2.78	3.97	12.4	3.22	2.7
5	12.2	3.6	8.25	5.32	2.7	2.1	2.5	2.55	3.52	15.2	3.1	2.7
6	11.2	3.5	7.05	4.9	2.78	2.05	2.38	2.2	3.15	11.9	3.0	2.62
7	7.9	3.3	5.85	4.6	2.75	2.08	2.42	1.7	2.92	9.4	2.9	2.5
8	5.15	3.15	4.9	4.25	3.8	2.05	2.15	2.92	2.7	7.2	2.8	2.48
9	5.35	3.08	4.38	4.15	3.3	2.08	1.85	2.98	2.5	6.65	2.72	2.45
10	4.7	3.45	3.95	5.45	2.9	1.97	1.6	4.0	2.4	5.52	2.65	2.35
11	4.1	3.0	3.5	5.02	2.9	1.8	1.6	3.72	2.05	4.82	2.75	2.35
12	3.85	2.82	3.3	5.2	2.72	1.7	1.6	3.65	2.2	4.12	2.85	2.5
13	3.8	2.65	3.15	5.15	2.6	1.6	1.68	4.82	2.5	3.62	2.85	2.38
14	3.9	2.8	3.02	4.7	2.55	1.65	1.55	3.72	3.15	3.25	2.68	2.3
15	4.12	2.65	3.3	10.0	2.25	1.85	1.42	2.95	2.55	3.12	2.55	2.25
16	4.1	2.5	8.65	9.4	2.35	1.75	1.3	4.32	2.4	2.9	2.65	2.2
17	4.0	2.4	6.45	7.25	2.28	2.0	1.6	5.58	2.25	2.82	2.58	2.2
18	3.95	2.32	6.95	6.82	2.2	2.4	1.7	9.32	2.08	3.1	2.48	3.8
19	3.9	2.38	5.98	5.9	2.15	1.88	1.6	6.75	2.15	7.8	8.9	3.75
20	3.7	2.1	8.7	5.15	2.12	1.98	1.58	5.32	2.38	21.8	9.95	8.2
21	3.55	2.3	6.95	4.75	2.2	5.2	2.72	5.65	2.11	23.3	10.8	7.48
22	3.32	2.38	6.58	4.47	2.0	7.05	2.3	4.82	2.02	18.7	10.2	6.0
23	3.28	2.45	5.62	4.15	2.8	6.85	2.88	6.55	2.0	12.2	7.3	5.25
24	3.95	2.3	5.0	3.95	1.9	4.47	3.3	4.6	2.2	9.55	5.95	4.72
25	11.3	2.2	4.92	3.58	1.78	3.68	2.5	7.0	2.3	8.05	4.85	4.15
26	7.82	2.15	4.71	3.49	1.75	3.08	1.9	5.35	2.32	7.08	4.45	3.62
27	6.22	2.0	5.3	3.48	2.72	5.3	1.65	6.28	2.25	6.2	4.18	3.3
28	9.0	2.2	5.71	3.5	2.85	3.65	1.95	9.05	2.05	5.9	3.82	3.5
29	7.6	.....	8.2	3.15	4.75	3.6	2.75	7.45	2.02	5.0	3.45	3.42
30	6.3	.....	9.05	2.95	3.48	3.45	5.4	9.1	2.35	4.55	3.22	3.3
31	5.85	.....	10.5	.....	3.28	.....	4.35	7.55	.....	4.2	.....	3.35

NOTE.—Discharge probably unaffected by ice.

Rating table for James River at Cartersville, Va., for 1899–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	2,170	3.00	5,550	4.70	9,530	7.80	18,330
1.40	2,350	3.10	5,770	4.80	9,780	8.00	18,970
1.50	2,530	3.20	5,990	4.90	10,040	9.00	22,300
1.60	2,710	3.30	6,210	5.00	10,300	10.00	25,750
1.70	2,900	3.40	6,440	5.20	10,820	11.00	29,260
1.80	3,090	3.50	6,670	5.40	11,350	12.00	32,930
1.90	3,280	3.60	6,900	5.60	11,890	13.00	36,670
2.00	3,480	3.70	7,130	5.80	12,430	14.00	40,520
2.10	3,680	3.80	7,360	6.00	12,980	15.00	44,500
2.20	3,880	3.90	7,590	6.20	13,540	16.00	48,600
2.30	4,080	4.00	7,830	6.40	14,100	17.00	52,820
2.40	4,280	4.10	8,070	6.60	14,680	18.00	57,200
2.50	4,490	4.20	8,310	6.80	15,260	19.00	61,700
2.60	4,700	4.30	8,550	7.00	15,860	20.00	66,300
2.70	4,910	4.40	8,790	7.20	16,460	21.00	71,300
2.80	5,120	4.50	9,030	7.40	17,080	22.00	76,900
2.90	5,330	4.60	9,280	7.60	17,700	23.00	82,900

NOTE.—The above table is applicable only for open-channel conditions. It is based on 25 discharge measurements made during 1897–1906. It is well defined between gage heights 0.7 foot and 10 feet. Between gage heights 10 feet and 20 feet the table is the product of the area curve by the extension of the velocity curve. Above 20 feet estimates are obtained in the same way, with the addition of a small overflow discharge.

Monthly discharge of James River at Cartersville, Va., for 1906.

[Drainage area, 6,230 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	52,800	6,170	13,800	2.22	2.56
February	11,300	3,480	5,380	.863	.90
March	27,500	3,920	12,700	2.04	2.35
April	25,800	5,440	11,600	1.86	2.08
May	9,660	3,000	4,910	.789	.91
June	16,000	2,710	5,850	.939	1.05
July	11,400	2,170	4,020	.645	.74
August	23,400	2,900	10,600	1.70	1.96
September	13,100	3,480	5,110	.820	.91
October	84,800	5,160	20,800	3.34	3.85
November	28,600	4,450	9,230	1.48	1.65
December	19,600	3,880	6,750	1.08	1.24
The year	84,800	2,170	9,230	1.48	20.20

NOTE.—Values for entire year are excellent.

The following table gives the horsepower (80 per cent efficiency) per foot of fall that may be developed at different rates of discharge, and shows the number of days on which the flow and the corresponding horsepower were respectively less than the amounts given in the columns for "discharge" and "horsepower:"

Discharge and horsepower table for James River at Cartersville, Va., from 1899 to 1906.

Discharge in second-feet.	Horsepower (80 per cent efficiency) per foot fall.	Number of days of deficient flow.							
		1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.
880	80	.....	3	.....	.....	.....	.....	.....	.....
990	90	.....	3	.....	8	.....	11	.....	.....
1,100	100	.....	12	.....	13	.....	15	.....	.....
1,320	120	4	19	.....	22	.....	40	.....	.....
1,540	140	14	31	.....	34	.....	75	.....	.....
1,760	160	42	59	.....	48	.....	95	13	.....
1,980	180	66	75	.....	52	1	100	32	.....
2,200	200	109	92	2	78	25	115	59	1
2,750	250	140	112	48	113	78	134	92	10
3,300	300	158	123	70	138	111	186	132	27
3,850	350	176	152	100	158	128	213	155	52
4,400	400	191	180	124	173	149	234	182	91
4,950	450	198	200	145	179	162	245	200	116
5,500	500	209	216	159	189	178	254	227	151

NOTE.—The ice conditions at this station during some of the winter months did not materially affect the results given in the above table.

Minimum flow from 1899 to 1906 was 842 second-feet, giving 77 horsepower on 3 days in September, 1900.

ROANOKE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Dan River joins the Roanoke at Clarksville, Mecklenburg County, Va., 185 miles above its mouth, and is its largest tributary. The Roanoke drains a total area of 9,200 square miles, and empties into Albemarle Sound a short distance below Plymouth, N. C. It is navigable at all stages for 120 miles, to Weldon, N. C., where it crosses the

fall line. The Dan and the Roanoke above their junction drain, respectively, 3,800 and 3,550 square miles. The Roanoke is the more northerly of the two, and its drainage basin lies entirely in Virginia. It rises among the eastern foothills of the Blue Ridge, southwest of Roanoke and Salem, and flows at first northeast, then southeast to its junction with the Dan. The Dan rises in Surry County, N. C., and Patrick County, Va., and flows at first southeast, then northeast to its junction with the Roanoke. A large part of the drainage area of the Dan lies in North Carolina.

During 1905 a survey of Roanoke River was made in order to determine a plan and profile and other information which would be of use in hydraulic developments. For description, plan, and profile of this survey see Bulletin No. 3 of the Geological Survey of Virginia.

The rainfall on the basin of the Roanoke above the fall line is about 48 inches per annum, and is evenly distributed throughout the year. The average amount probably increases slightly as the stream is ascended, though the records of rainfall over the basin are too incomplete to decide this matter. The slopes in the headwaters and in the upper tributaries are steep, freshets on the river are violent, and the fluctuations of height occur with great rapidity. Rises of 50 feet and over have been noted at Weldon, and freshets in which the rate of rise is 10 feet a day or more are frequent.

The United States Weather Bureau maintains gages at Clarksville, Va., at the junction of the Dan and Roanoke; on Dan River at Danville, Va., and on Roanoke River at Weldon, N. C.

ROANOKE RIVER AT ROANOKE, VA.

This station was established July 10, 1896, and was discontinued July 15, 1906. The gage is located at the Walnut Street Bridge, Roanoke, but the measuring section is at the Jefferson Street Bridge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 102, where are given also references to publications that contain data for previous years.

The following discharge measurement was made June 10, 1906:

Width, 112 feet; area, 124 square feet; gage height, .76 feet; discharge, 119 second-feet.

Daily gage height, in feet, of Roanoke River at Roanoke, Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	1.35	1.8	1.0	2.3	1.35	1.1	0.8
2	1.3	1.7	1.1	2.05	1.3	1.0	.8
3	4.8	1.6	1.15	1.75	1.3	.9	.75
4	3.6	1.5	1.7	1.65	1.2	.7	.75
5	2.8	1.5	1.5	1.55	1.1	.8	.7
6	2.15	1.5	1.4	1.5	1.2	.8	.7
7	1.85	1.4	1.3	1.45	1.3	.8	.7
8	1.75	1.4	1.3	1.4	1.3	.8	.7
9	1.65	1.35	1.3	1.4	1.3	.7	.7
10	1.5	1.3	1.2	1.7	1.1	.8	.7

Daily gage height, in feet, of Roanoke River at Roanoke, Va., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
11	1.5	1.2	1.2	1.6	1.1	.8	.7
12	1.5	1.2	1.2	1.55	1.1	.8	.65
13	1.4	1.2	1.2	1.4	1.0	1.4	.65
14	1.4	1.2	1.15	1.4	1.0	1.3	.65
15	1.5	1.2	1.4	1.8	.9	1.2	.7
16	1.5	1.2	1.5	2.0	1.0	1.1	.....
17	1.5	1.2	2.0	1.85	1.0	1.0	.....
18	1.45	1.1	2.1	1.7	1.0	1.0	.....
19	1.4	1.1	2.2	1.6	1.0	.9	.....
20	1.35	1.1	2.2	1.5	.9	.8	.....
21	1.3	1.1	2.2	1.4	1.4	1.1	.....
22	1.3	1.05	2.1	1.6	1.3	1.0	.....
23	4.05	1.05	2.0	1.5	1.4	.9	.....
24	2.7	1.05	1.8	1.4	1.4	.8	.....
25	2.2	1.05	1.7	1.3	1.2	.8	.....
26	2.05	1.05	1.6	1.3	1.1	.8	.....
27	1.85	1.1	2.15	1.2	1.0	.8	.....
28	1.3	1.0	2.2	1.15	1.0	.8	.....
29	2.2	.....	2.1	1.5	1.0	.8	.....
30	2.0	.....	2.05	1.4	.9	.8	.....
31	1.9	.....	2.0	.....	1.1	.....	.....

NOTE.—Discharge probably unaffected by ice.

Rating table for Roanoke River at Roanoke, Va., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.60	74	1.60	470	2.60	1,240	3.60	2,390
.70	96	1.70	530	2.70	1,340	3.70	2,515
.80	122	1.80	590	2.80	1,440	3.80	2,645
.90	152	1.90	655	2.90	1,550	3.90	2,775
1.00	186	2.00	725	3.00	1,660	4.00	2,905
1.10	224	2.10	800	3.10	1,780	4.20	3,175
1.20	264	2.20	880	3.20	1,900	4.40	3,445
1.30	310	2.30	960	3.30	2,020	4.60	3,715
1.40	360	2.40	1,050	3.40	2,140	4.80	3,985
1.50	415	2.50	1,140	3.50	2,265		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1896–1906. It is fairly well defined.

Monthly discharge of Roanoke River at Roanoke, Va., for 1906.

[Drainage area, 388 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	3,980	310	808	2.08	2.40
February	590	186	209	.771	.80
March	880	186	524	1.35	1.56
April	960	244	459	1.18	1.32
May	360	152	243	.626	.72
June	360	96	161	.415	.46
July 1–15	122	85	99	.255	.14

NOTE.—Values for entire year are good.

The following table gives the horsepower (80 per cent efficiency) per foot of fall that may be developed at different rates of discharge, and shows the number of days on which the flow and the corresponding horsepower were, respectively, less than the amounts given in the columns for "discharge" and "horsepower."

Discharge and horsepower table for Roanoke River at Roanoke, Va., from 1896 to 1906.

Discharge in second-feet.	Horsepower (80 per cent efficiency) per foot fall.	Number of days of deficient flow.										
		1896.[a]	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.[b]
66	6	.....	8	.....	.....	1	.....	.....	.....	.....	.....	.....
88	8	36	101	21	43	43	.....	70	6	7	2	3
110	10	111	142	39	125	66	.....	108	17	78	7	15
132	12	120	156	48	140	80	1	121	31	132	55	32
154	14	126	182	83	167	107	9	144	87	164	101	38
176	16	127	182	95	179	127	29	154	103	181	115	38
198	18	129	194	110	185	150	51	162	124	217	135	53
220	20	129	195	122	194	165	70	174	136	238	139	58
275	25	134	206	137	205	190	112	198	173	287	188	92
330	30	139	216	155	218	215	145	220	195	302	227	109

[a] July to December, 1896. [b] January to July 15, 1906.

NOTE.—The minimum flow during the period covered by the above table was 58 second-feet, giving 5.3 horsepower per foot of fall on one day in February, 1900.

ROANOKE RIVER[a] AT RANDOLPH, VA.

This station was originally established August 27, 1900. It is located on the railroad bridge about five-eighths mile southwest of the Southern Railway station at Randolph. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 104, where are given also references to publications that contain data for previous years.

The following discharge measurement was made June 8, 1906:

Width, 237 feet; area, 735 square feet; gage height, 4.20 feet; discharge, 1,440 second-feet.

Daily gage height, in feet, of Roanoke River at Randolph, Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	10.3	11.5	5.75	9.85	4.65	5.6	5.95	8.5
2	8.65	10.1	5.75	7.95	4.8	5.4	5.65	6.55
3	6.6	7.5	5.6	7.15	4.9	5.4	5.3	6.4
4	12.9	6.2	5.75	6.75	4.8	5.4	5.05	6.85
5	23.6	6.2	5.85	6.45	4.65	5.6	4.85	7.1
6	19.8	6.35	5.9	6.4	4.85	5.5	4.75	7.3
7	7.65	6.3	6.15	6.15	5.15	5.45	4.75	7.1
8	6.7	6.25	6.0	5.95	5.7	5.15	4.55	6.9
9	6.75	6.25	5.85	6.35	6.05	5.25	4.55	6.7
10	6.9	7.05	5.75	7.5	5.9	5.35	4.85	7.4
11	6.85	6.85	5.85	8.95	5.55	5.1	5.25	7.5
12	6.95	6.65	5.85	9.15	5.5	5.15	5.8	.....
13	7.15	6.25	5.85	8.65	5.0	5.05	5.9	.....
14	7.25	5.7	5.75	7.3	5.05	4.95	5.65	.....
15	6.75	6.05	5.65	8.25	4.9	5.2	5.45	.....

[a] Called Staunton River in reports prior to 1905.

Daily gage height, in feet, of Roanoke River at Randolph, Va., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
16	6.55	5.85	5.65	8.2	4.85	5.2	5.25	.....
17	6.35	5.65	5.85	7.5	4.65	5.25	4.75	.....
18	6.3	5.45	8.85	7.35	4.75	5.35	4.45	.....
19	5.85	5.35	7.7	7.35	4.65	5.65	4.25	.....
20	5.4	5.35	13.0	7.4	4.65	5.15	4.4	.....
21	5.85	5.25	11.0	7.0	4.45	7.2	5.05	.....
22	5.85	5.35	9.1	6.75	4.45	9.35	5.55	.....
23	5.65	5.15	7.75	6.45	4.2	6.95	6.5	.....
24	5.75	4.95	7.05	6.45	4.1	5.1	6.15	.....
25	5.6	4.95	6.8	6.3	3.9	7.75	5.3	.....
26	5.8	4.85	6.75	5.95	4.1	7.4	4.6	.....
27	6.05	5.15	6.75	5.65	4.45	6.65	4.55	.....
28	10.6	5.35	7.15	5.6	5.75	6.35	4.25	.....
29	11.55	.....	7.35	5.25	8.9	6.65	4.5	.....
30	12.4	.....	8.75	5.0	8.3	6.25	7.45	.....
31	12.5	.....	15.6	.....	6.55	.....	7.75	.....

NOTE.—Discharge probably unaffected by ice.

DAN RIVER AT MADISON, N. C.

This station was established May 14, 1903. It is located at the Southern Railway bridge about one-fourth mile from Madison and one-half mile above the mouth of Mayo River. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 107, where are given also references to publications that contain data for previous years.

The following discharge measurement was made June 21, 1906:

Width, 142 feet; area, 374 square feet; gage height, 2.37 feet; discharge, 729 second-feet.

Daily gage height, in feet, of Dan River at Madison, N. C., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.4	3.0	2.25	3.4	1.75	1.3	1.7	3.3	3.9	2.9	2.35	2.05
2	2.15	2.6	2.0	2.75	1.85	1.2	1.65	4.0	3.1	2.7	2.3	2.0
3	2.0	2.25	1.7	2.4	1.95	1.2	2.0	4.3	2.9	2.5	2.2	2.0
4	17.9	2.0	5.4	2.4	2.0	1.15	1.85	2.6	3.1	5.9	2.15	1.95
5	5.4	2.1	3.1	2.3	2.05	1.1	1.7	2.15	2.85	3.6	2.15	1.95
6	3.7	2.3	2.65	2.25	1.7	6.1	1.6	2.15	2.5	2.9	2.15	1.9
7	2.9	2.2	2.3	2.25	2.4	1.9	1.8	1.9	2.3	3.2	2.1	1.9
8	2.75	2.1	2.1	2.05	2.15	2.0	1.5	1.9	2.2	2.9	2.1	1.85
9	2.55	2.0	2.1	2.1	1.85	1.9	4.8	1.8	2.1	2.45	2.1	1.8
10	2.35	2.2	2.0	2.7	1.5	1.8	2.9	1.8	2.05	3.1	2.05	1.8
11	2.2	2.1	1.8	2.45	1.5	2.5	1.8	1.8	1.9	2.6	2.05	2.6
12	2.25	2.0	1.75	2.1	1.5	1.85	1.45	1.6	1.8	2.1	2.15	2.2
13	4.2	2.0	1.75	2.05	1.5	2.0	1.5	5.2	5.4	2.0	2.1	1.9
14	4.8	2.0	1.7	2.0	1.45	3.6	1.5	3.1	3.5	2.0	2.1	1.9
15	3.4	1.9	2.15	3.1	1.45	3.1	1.4	5.0	2.4	1.95	2.05	1.9
16	3.0	1.8	5.3	2.8	1.4	3.5	5.0	14.9	2.1	1.9	2.15	1.85
17	2.75	1.7	3.2	2.45	1.3	4.0	2.4	15.5	2.1	2.0	2.1	1.85
18	2.4	1.8	2.6	2.25	1.3	3.2	4.5	14.3	2.1	2.3	2.0	4.4
19	2.3	1.75	2.15	2.15	1.3	2.5	2.3	5.9	2.0	9.3	2.5	3.9
20	2.2	1.7	7.4	2.1	1.25	3.9	2.3	7.6	3.5	7.5	4.6	4.2
21	2.15	1.65	4.0	2.05	1.25	2.5	6.3	4.2	2.65	5.0	3.2	4.6
22	2.0	3.2	2.8	1.95	1.25	3.3	6.5	3.2	2.4	4.2	2.8	2.9
23	10.1	2.8	2.6	1.95	1.25	2.35	6.3	2.9	3.0	3.6	2.5	2.6
24	6.6	2.25	2.45	1.9	1.2	1.8	2.4	2.7	2.85	3.2	2.3	2.2
25	4.4	2.0	2.15	1.8	1.2	3.3	4.4	2.5	2.75	3.0	2.2	2.0
26	3.2	1.9	2.7	1.75	1.15	6.2	2.1	2.65	2.4	2.9	2.2	1.85
27	6.1	1.75	2.6	1.7	2.2	2.7	1.8	3.2	2.2	2.8	2.15	1.8
28	6.4	2.65	2.5	1.7	2.0	2.0	4.2	6.1	2.0	2.7	2.1	2.0
29	4.6	.....	2.55	1.65	1.6	1.9	2.4	8.6	2.0	2.5	2.1	2.4
30	3.9	.....	2.9	1.7	1.5	1.8	7.7	7.5	2.1	2.5	2.05	2.25
31	3.4	.....	5.0	.....	1.4	.....	6.8	5.8	.....	2.4	.....	4.2

NOTE. Discharge probably unaffected by ice.

DAN RIVER AT SOUTH BOSTON, VA.

This station was established August 27, 1900. It is located in South Boston, on the Norfolk and Western Railway bridge, which crosses the river at that place. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 109, where are given also references to publications that contain data for previous years.

The following discharge measurement was made June 9, 1906:

Width, 252 feet; area, 1,310 square feet; gage height, 213 feet; discharge, 1,850 second-feet.

Daily gage height, in feet, of Dan River at South Boston, Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.25	2.9	4.28	8.75	2.6	1.68	2.6	3.35	4.18	2.55	3.0	1.98
2	3.95	2.25	4.12	5.75	2.3	1.38	2.28	4.2	4.25	5.85	3.1	2.08
3	4.55	2.25	4.35	4.5	2.4	1.45	2.0	3.4	4.05	3.95	2.85	2.02
4	16.1	2.05	5.0	4.4	2.55	1.58	2.05	3.65	5.95	4.15	2.55	2.05
5	19.7	3.75	5.65	3.8	2.18	1.55	2.18	3.25	4.6	8.75	2.35	2.15
6	18.0	4.3	4.8	3.52	2.3	1.4	3.7	3.75	3.88	7.32	2.3	2.35
7	9.6	3.02	3.82	2.7	3.48	1.6	3.95	3.3	3.28	4.95	2.08	2.4
8	6.6	3.85	3.45	3.08	3.95	1.65	4.0	3.08	2.85	3.6	2.18	2.22
9	5.62	4.65	3.42	3.7	3.02	1.75	3.5	3.32	2.62	2.5	2.22	2.28
10	3.75	4.5	3.1	5.25	2.2	3.65	3.45	3.2	2.15	1.25	2.4	2.42
11	3.35	3.8	2.75	5.1	2.25	4.82	3.05	4.08	1.82	1.1	2.35	2.52
12	4.2	3.6	2.3	4.08	2.35	3.58	2.75	4.4	1.9	1.18	2.6	2.55
13	3.4	3.18	2.58	3.45	2.5	2.7	2.22	4.75	1.85	.95	2.55	2.62
14	5.0	3.18	2.9	3.88	2.18	2.12	2.28	5.45	2.15	.....	2.3	2.72
15	6.35	2.9	3.65	4.8	1.78	1.78	2.95	6.48	2.02	.....	2.52	2.6
16	4.3	2.6	5.15	5.7	1.85	1.8	3.08	7.72	2.3	.....	2.42	2.65
17	5.35	2.95	4.65	4.5	1.82	3.1	3.18	10.8	2.3	2.75	2.55	2.75
18	4.45	2.9	3.5	3.58	1.92	3.92	3.7	15.6	2.2	2.8	2.75	2.8
19	4.1	2.7	4.05	3.18	2.05	3.42	4.05	18.5	2.25	4.65	2.8	2.62
20	3.65	2.55	4.0	2.88	1.92	5.78	4.95	17.0	2.48	7.12	3.05	2.52
21	3.05	2.65	5.95	2.68	1.85	4.7	6.75	13.7	3.85	12.75	3.18	2.42
22	3.85	3.5	5.9	2.58	1.98	3.6	10.0	8.9	4.42	8.4	3.2	2.35
23	7.9	2.32	4.05	2.7	1.85	3.9	12.5	7.68	3.9	6.5	2.55	2.22
24	12.3	2.35	3.25	2.58	1.42	3.65	10.3	6.08	3.38	5.05	2.55	2.3
25	8.35	2.5	4.3	2.52	1.8	3.42	8.0	4.85	3.22	4.6	2.35	2.18
26	6.9	2.55	3.8	2.55	2.35	3.35	7.75	4.08	3.15	4.12	2.22	2.12
27	6.0	2.75	4.25	2.42	3.0	6.6	6.65	4.18	2.5	3.9	2.15	2.02
28	8.85	4.12	4.9	2.32	3.5	3.5	7.48	4.18	1.9	3.8	2.1	2.02
29	9.4	.....	4.6	2.88	3.45	2.55	5.35	4.65	2.12	3.85	2.05	2.12
30	7.68	.....	8.3	2.85	1.7	2.42	3.7	4.95	1.98	3.92	1.92	4.75
31	6.3	.....	11.3	.....	1.55	.....	3.4	4.02	.....	3.75	.....	10.7

NOTE.—Discharge probably unaffected by ice.

Rating table for Dan River at South Boston, Va., for 1903-6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	1,014	2.40	2,186	3.90	3,400	6.80	6,034
1.00	1,091	2.50	2,265	4.00	3,484	7.00	6,234
1.10	1,168	2.60	2,345	4.20	3,653	8.00	7,275
1.20	1,245	2.70	2,425	4.40	3,824	9.00	8,415
1.30	1,323	2.80	2,505	4.60	3,997	10.00	9,700
1.40	1,401	2.90	2,585	4.80	4,172	11.00	11,100
1.50	1,479	3.00	2,665	5.00	4,349	12.00	12,540
1.60	1,557	3.10	2,746	5.20	4,528	13.00	14,000
1.70	1,635	3.20	2,827	5.40	4,709	14.00	15,500
1.80	1,713	3.30	2,908	5.60	4,892	15.00	17,180
1.90	1,791	3.40	2,989	5.80	5,077	16.00	19,100
2.00	1,870	3.50	3,070	6.00	5,264	17.00	21,650
2.10	1,949	3.60	3,152	6.20	5,453	18.00	24,600
2.20	2,028	3.70	3,234	6.40	5,644	19.00	27,800
2.30	2,107	3.80	3,317	6.60	5,838	20.00	31,200

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-1906 and is fairly well defined. Below gage height 10.4 feet the table is the same as that published for 1904.

Monthly discharge of Dan River at South Boston, Va., for 1906.

[Drainage area, 2,750 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	30,200	2,700	7,160	2.60	3.00
February	4,040	1,910	2,750	.999	1.04
March	11,500	2,110	3,960	1.44	1.66
April	8,120	2,120	3,320	1.21	1.35
May	3,440	1,420	2,130	.774	.89
June	5,840	1,380	2,650	.963	1.07
July	13,300	1,870	4,250	1.55	1.79
August	26,200	2,730	6,410	2.33	2.69
September	5,220	1,730	2,670	.971	1.08
October	13,600	1,050	3,870	1.41	1.63
November	2,830	1,810	2,270	.825	.92
December	10,700	1,850	2,480	.902	1.04
The year	30,200	1,050	3,660	1.33	18.16

NOTE.—Values for entire year are good.

The following table gives the horsepower (80 per cent efficiency) per foot of fall that may be developed at different rates of discharge, and shows the number of days on which the flow and the corresponding horsepower were respectively less than the amounts given in the columns for "discharge" and "horsepower."

Discharge and horsepower table for Dan River at South Boston, Va., from 1900 to 1906.

Discharge in second-feet.	Horsepower, 80 per cent efficiency, per foot fall.	Number of days of deficient flow.						
		1900.[a]	1901.	1902.	1903.	1904.	1905.	1906.
385	35					1		
440	40					3		
495	45					4		
550	50					6		
660	60					15		
770	70	5				19		
880	80	10				36		
990	90	11		4		46	4	
1,100	100	15		22		57	16	1
1,320	120	27		64	6	89	55	4
1,540	140	47		92	59	165	113	10
1,760	160	64	29	100	112	212	144	29
1,980	180	80	78	112	122	248	172	54
2,200	200	83	129	133	131	275	194	101
2,750	250	111	244	167	161	307	236	175

[a] September 1 to December 31, 1900.

NOTE.—Minimum flow from September 1, 1900, to December 31, 1906, was 375 second-feet, giving 34 horsepower per foot of fall in October, 1904.

CAPE FEAR RIVER DRAINAGE BASIN.

MISCELLANEOUS MEASUREMENT.

The following measurement was made in Cape Fear River drainage basin in 1906:

South Buffalo Creek, near Greensboro, N. C.—A measurement was made June 21, 1906, at the Southern Railway trestle about 2 miles south of Greensboro. The bench mark is the top of the upstream

end of the seventh bent cap from the left end of trestle; elevation, 29.50 feet above datum of the assumed gage.

Width, 16 feet; area, 12 square feet; gage height, 1.22 feet; discharge, 7.6 second-feet.

YADKIN, OR PEDEE, RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Yadkin River, called Pedee River, below the junction with the Uharie, rises on the eastern slope of the Blue Ridge, in Caldwell and Watauga counties, N. C., and flows at first southeastward, then turns abruptly to the northeast, and after flowing in this direction for about 60 miles again bends abruptly and flows southward and southeastward across North Carolina and South Carolina, emptying into Winyah Bay at Georgetown, S. C. The total length of the stream from source to mouth, in its general direction, is from 275 to 300 miles, but with all the windings it is probably 400 miles or more.

The Pedee drains a total area of about 17,000 square miles, of which 9,700 square miles are in North Carolina and 7,300 in South Carolina. It crosses the fall line near Cheraw, S. C., in a series of rapids extending over a number of miles, with no very great fall at any one place or in any short distance.

The upper part of the drainage basin is rough and mountainous and is largely forest covered, and throughout this part of its course the flow of the stream is more constant than would be expected. Below the great bend, where the river turns to the south, the valley averages about 50 miles in width. At many points the river is bordered by wide expanses of bottom lands, which are fertile and very productive, but are at times subject to overflow. At other places the stream is confined between bold and abrupt banks, and in one place it flows for several miles in a narrow channel, parts of which are only 60 feet wide, in a deep ravine between the flanking hills, forming the noted "Narrows." Above the great bend the valley is from 15 to 20 miles wide, and the elevations of the divides which separate the basin of the Yadkin from adjacent drainage basins are much higher, so that the tributary streams have a large fall.

Small amounts of power may be developed on some of the tributaries of this river in South Carolina, but the power possibilities of the basin in this State are unimportant. In North Carolina both the main stream and many of its tributaries can be made to furnish power in large amount at a number of places, and for this reason they are among the most important power streams in the Southern States.

The average rainfall over the part of the basin in North Carolina is probably between 48 and 51 inches, approximating the smaller figure over the lower portions, and possibly exceeding the larger over

the higher and more mountainous portions, the precipitation increasing toward the head of the stream. The total amount is rather evenly distributed among the seasons.

What is said to be the highest flood ever known at Wilkesboro occurred in March, 1899, the stream rising 28 feet above low water. The greatest flood recorded at the gaging station at Salisbury occurred in December, 1901, the stream reaching an extreme height on the gage of 19.7 feet and having a probable discharge of about 130,000 second-feet, or about 38 second-feet per square mile. The flood of March, 1899, produced a rise of about 1 foot less than this flood of December, 1901. The most destructive flood ever experienced on the river occurred in May, 1901, but the recorded gage height at the Salisbury station was less for this flood than for either of the others mentioned, and the general testimony of those living along the banks is to the same effect.

The minimum recorded flow at the Salisbury station occurred in September, October, and November, 1897, when the basin experienced the most severe drought in its history. The flow fell to 900 second-feet several times during this period, i. e., the basin above the station was discharging at an average rate of 0.26 second-foot per square mile. The maximum flow is thus about 144 times the minimum.

The United States Weather Bureau maintains river stations on the Pedee at Cheraw and at Smiths Mills, S. C.

YADKIN RIVER NEAR SALISBURY, N. C.

This station was established September 24, 1895. It is located at the Piedmont toll bridge, about 6 miles east of Salisbury, N. C.

The bridge is a five-span steel structure situated 300 yards above the Southern Railway bridge. The channel curves to the right a short distance below the bridge. The bed is rocky. The discharge is modified considerably at times by drift wood lodging against the piers.

Discharge measurements are made from the bridge to which the gage is attached. The gage was first established on the railroad bridge 300 yards below. In 1899 a gage was put on the toll bridge, and this was used until 1903, when the station was moved back to the railroad bridge. In the latter part of 1905 simultaneous readings of the gages on both bridges were commenced and continued during the greater part of 1906. This was to determine the relation between the two gages, as it was finally decided to continue the gage readings from the toll bridge. All 1906 gage heights refer to the toll-bridge gage.

The gage is of the standard chain type, fastened to the downstream lower chord in the second span from the left end. The chain length

is 26.87 feet. The gage is read once each day by J. V. Yarbrough, the toll collector. The reference point is the top of the downstream end of the first floor beam of the second span from the right bank; elevation, 23.14 feet above the gage zero. The bench mark is a standard copper plug set in a rock on right bank on the upstream side of the road, 5 feet from the tollgate and 6.4 feet upstream from the upstream side of bridge produced; elevation, 31.49 feet above the datum of the toll-bridge gage.

Discharge measurements of Yadkin River near Salisbury, N. C., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 3	E. C. Murphy	462	2,220	2.58	3,430
June 22	W. E. Hall	475	2,380	3.10	5,050
September 11	do	474	2,440	3.04	4,970

Daily gage height, in feet, of Yadkin River near Salisbury, N. C., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.8	3.55	2.6	4.8	2.75	2.2	2.5	3.95	9.8	3.55	2.9	2.85
2	2.65	3.35	2.55	3.9	2.8	2.15	2.55	5.3	6.7	3.2	2.9	2.95
3	2.4	3.2	2.5	3.35	2.85	2.3	2.3	5.7	4.2	3.3	2.85	2.9
4	8.4	3.0	2.7	3.15	2.85	2.35	2.7	4.1	5.0	4.0	2.95	2.8
5	9.1	3.0	4.0	3.0	2.95	2.75	4.2	3.45	4.2	4.8	2.9	2.8
6	5.1	3.0	3.2	2.95	3.0	3.0	2.9	3.15	3.65	4.0	2.8	2.8
7	3.7	2.9	2.9	2.9	2.85	2.75	2.5	2.9	3.4	3.7	2.8	2.75
8	3.2	2.8	2.8	2.9	3.55	2.45	2.8	2.8	3.25	3.5	2.8	2.8
9	3.05	2.8	2.8	2.85	3.05	2.35	3.6	2.75	3.2	3.15	2.75	2.8
10	2.85	2.85	2.8	2.9	2.65	2.7	4.4	2.65	3.1	3.05	2.75	2.8
11	2.7	2.8	2.7	3.0	2.5	4.6	3.3	2.55	2.95	3.1	2.9	3.1
12	3.0	2.7	2.7	2.8	2.4	3.8	2.7	2.55	2.95	2.95	2.85	3.35
13	4.0	2.6	2.5	2.65	2.55	3.0	2.45	2.55	3.15	2.8	2.75	3.1
14	3.85	2.6	2.5	2.65	2.55	3.9	2.35	2.65	4.2	3.0	2.75	2.9
15	3.7	2.65	2.6	2.85	2.35	5.0	2.4	3.6	3.4	2.8	2.75	2.8
16	3.5	2.55	5.4	3.6	2.3	5.9	2.8	5.4	3.1	2.75	2.85	2.85
17	3.2	2.5	4.6	3.5	2.35	5.8	4.6	8.2	2.8	2.75	2.85	2.85
18	3.0	2.6	3.55	3.05	2.25	4.5	3.4	5.6	2.8	2.8	2.85	3.1
19	2.85	2.65	3.15	2.85	2.25	4.0	3.2	4.8	2.95	3.7	3.0	3.4
20	2.75	2.5	5.5	2.7	2.35	3.4	3.05	3.8	3.4	9.4	8.5	3.2
21	2.75	2.45	5.0	2.65	2.4	3.4	3.9	4.0	3.2	7.1	7.2	3.5
22	2.75	2.9	3.8	2.75	2.2	2.95	6.9	4.0	3.0	4.8	4.1	3.4
23	4.8	3.0	3.3	2.75	2.2	3.3	6.4	3.85	3.5	4.1	3.65	3.2
24	9.0	2.9	3.05	2.35	2.2	2.7	5.0	3.55	3.5	3.7	3.35	3.0
25	5.5	2.7	3.1	2.3	2.2	3.1	3.85	3.25	3.5	3.5	3.25	2.8
26	4.3	2.7	3.1	2.25	2.15	3.45	5.7	3.15	3.0	3.35	3.2	2.55
27	4.7	2.5	3.0	2.25	2.35	3.8	4.2	3.25	2.8	3.25	3.05	2.5
28	7.2	2.55	2.95	2.5	2.8	3.0	5.9	3.65	2.85	3.15	3.05	2.9
29	6.4	.....	3.05	2.6	2.7	2.7	3.55	4.8	3.15	3.15	3.0	2.95
30	4.8	.....	3.4	2.65	2.4	2.7	3.35	10.9	3.25	3.0	2.9	3.0
31	4.0	.....	4.4	.....	2.25	.....	4.2	11.9	.....	3.0	.....	3.15

Rating table for Yadkin River near Salisbury, N. C., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	1,990	3.30	5,860	4.60	10,830	6.80	20,950
2.10	2,220	3.40	6,220	4.70	11,240	7.00	22,060
2.20	2,460	3.50	6,580	4.80	11,650	7.20	23,210
2.30	2,720	3.60	6,950	4.90	12,070	7.40	24,400
2.40	2,990	3.70	7,320	5.00	12,490	7.60	25,600
2.50	3,270	3.80	7,700	5.20	13,340	7.80	26,800
2.60	3,560	3.90	8,080	5.40	14,210	8.00	28,000
2.70	3,860	4.00	8,460	5.60	15,090	9.00	34,000
2.80	4,170	4.10	8,850	5.80	15,990	10.00	40,000
2.90	4,490	4.20	9,240	6.00	16,910	11.00	46,000
3.00	4,820	4.30	9,630	6.20	17,860	12.00	52,000
3.10	5,160	4.40	10,030	6.40	18,850		
3.20	5,510	4.50	10,430	6.60	19,880		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1901-1906. It is well defined between gage heights 2 feet and 11 feet. Above gage height 7.30 feet the rating curve is a tangent, the difference being 60.0 per tenth. Measurements made at the railroad bridge have been referred to the toll bridge gage by means of a series of simultaneous readings. This table refers to the toll bridge gage.

Monthly discharge of Yadkin River near Salisbury, N. C., for 1906.

[Drainage area, 3,400 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	34,600	2,990	10,300	3.03	3.49
February	6,760	3,130	4,190	1.23	1.28
March	14,600	3,270	6,020	1.77	2.04
April	11,600	2,590	4,630	1.36	1.52
May	6,760	2,340	3,460	1.02	1.18
June	16,400	2,340	6,230	1.83	2.04
July	21,500	2,720	7,540	2.22	2.56
August	51,400	3,420	10,900	3.21	3.70
September	38,800	4,170	7,630	2.24	2.50
October	36,400	4,010	7,700	2.26	2.61
November	31,000	4,010	6,140	1.81	2.02
December	6,580	3,270	4,720	1.39	1.60
The year	51,400	2,340	6,620	1.95	26.54

NOTE. Values for 1906 are excellent.

YADKIN RIVER AT NORTH WILKESBORO, N. C.

This station was established April 10, 1903. It is located at the lower highway bridge between Wilkesboro and North Wilkesboro, about one-half mile below North Wilkesboro railroad station and three-fourths mile below the mouth of Reddie River. The conditions at this station and the bench marks are described in Water-Supply Paper No. 167, page 118, where are given also references to publications that contain data for previous years.

Discharge measurements of Yadkin River at North Wilkesboro, N. C., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 19	W. E. Hall	101	629	3.00	2,3[illegible]
June 19	do	101	619	2.94	2,2[illegible]

Daily gage height, in feet, of Yadkin River at North Wilkesboro, N. C., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.65	2.35	1.1	2.95	1.15	0.65	1.1	3.7	4.6	3.8	2.45	2.35
2	.65	2.1	1.0	2.35	1.25	1.2	1.0	4.3	3.6	3.7	2.4	2.35
3	4.6	1.75	1.15	2.0	1.15	.75	1.1	3.2	3.1	7.0	2.4	2.3
4	5.8	1.5	4.3	1.8	1.5	.65	2.0	2.6	2.9	7.0	2.35	2.25
5	2.85	1.65	2.5	1.65	1.8	1.4	1.15	2.2	2.9	5.1	2.3	2.2
6	2.0	1.6	1.9	1.6	1.25	3.1	3.0	1.9	2.6	4.3	2.3	2.2
7	1.5	1.45	1.65	1.45	4.8	1.4	1.35	1.9	2.55	3.7	2.2	2.2
8	1.35	1.35	1.6	1.4	1.9	1.05	1.15	1.7	2.4	3.3	2.2	2.1
9	1.2	1.35	1.45	1.35	1.5	1.3	2.4	1.5	2.25	3.0	2.2	2.1
10	.95	1.25	1.3	1.65	1.3	1.4	1.45	1.4	2.1	3.0	2.1	2.1
11	.95	1.2	1.15	1.3	1.2	2.5	1.15	1.5	2.0	2.75	2.1	2.7
12	3.1	1.25	1.15	1.25	1.1	1.2	1.05	1.25	2.0	2.65	2.2	2.2
13	2.2	1.25	1.1	1.2	1.05	2.1	1.05	1.85	2.35	2.6	2.1	2.1
14	3.1	1.2	1.1	1.2	1.0	6.3	.95	2.15	2.15	2.5	2.0	2.1
15	2.6	1.15	2.7	4.2	.9	7.4	2.3	6.2	1.9	2.4	2.15	2.0
16	2.2	1.1	2.8	2.4	.85	5.5	5.0	4.0	1.9	2.4	2.1	2.0
17	1.8	1.0	2.0	1.9	.85	4.7	2.25	3.7	1.85	2.6	2.05	2.1
18	1.6	1.0	1.6	1.65	.8	3.8	2.5	3.7	1.85	2.9	2.85	2.4
19	1.45	1.0	1.65	1.55	.9	3.4	1.9	3.0	3.8	17.9	18.8	2.1
20	1.3	1.0	2.9	1.45	.8	2.6	1.65	2.4	2.9	7.9	7.0	2.5
21	1.2	1.0	2.2	1.4	.75	2.0	1.95	3.5	2.6	4.9	4.6	2.35
22	1.4	1.75	1.9	1.35	.7	2.7	3.0	3.3	2.65	4.1	3.8	2.2
23	12.3	1.15	1.6	1.35	.7	1.7	2.25	3.3	2.9	3.6	3.3	2.15
24	5.0	1.1	1.5	1.2	.7	1.6	2.6	2.4	3.2	3.3	3.0	2.0
25	3.3	1.1	1.5	1.15	.65	2.6	4.4	2.1	2.35	3.15	2.8	1.5
26	2.8	1.1	1.5	1.15	.75	1.7	2.1	2.15	2.15	3.0	2.75	1.7
27	3.3	1.1	1.5	1.15	1.95	1.4	2.6	2.35	2.75	2.9	2.55	1.9
28	4.0	1.15	1.5	1.15	1.3	1.25	2.3	3.4	3.0	2.75	2.65	1.9
29	3.6	.....	1.45	1.05	.9	1.25	1.75	18.0	6.6	2.65	2.45	2.1
30	2.9	.....	4.6	1.6	.75	1.25	2.95	9.2	4.4	2.6	2.35	2.0
31	2.6	.....	4.3	.....	.7	.....	2.35	7.2	.....	2.55	.....	7.6

Rating table for Yadkin River at North Wilkesboro, N. C., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
−0.60	215	0.80	745	2.40	1,725	6.00	5,100
−.50	245	.90	790	2.60	1,880	7.00	6,100
−.40	275	1.00	840	2.80	2,045	8.00	7,100
−.30	305	1.10	890	3.00	2,220	9.00	8,100
−.20	340	1.20	945	3.20	2,400	10.00	9,100
−.10	375	1.30	1,000	3.40	2,580	11.00	10,100
.00	410	1.40	1,055	3.60	2,760	12.00	11,100
.10	450	1.50	1,115	3.80	2,950	13.00	12,100
.20	490	1.60	1,175	4.00	3,140	14.00	13,100
.30	530	1.70	1,240	4.20	3,330	15.00	14,100
.40	570	1.80	1,305	4.40	3,520	16.00	15,100
.50	610	1.90	1,370	4.60	3,710	16.00	16,100
.60	655	2.00	1,440	4.80	3,900	18.00	17,100
.70	700	2.20	1,580	5.00	4,100	19.00	18,100

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1906. Owing to changing conditions of flow, it can not be considered as very well defined. Above gage height 4.8 feet, the rating curve is a tangent, the difference being 100 per tenth.

Monthly discharge of Yadkin River at North Wilkesboro, N. C., for 1905–6.

[Drainage area, 500 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
January	3,330	215	720	1.44	1.66
February	2,860	340	929	1.86	1.94
March	1,060	570	740	1.48	1.71
April	2,950	530	772	1.54	1.72
May	3,240	510	1,010	2.02	2.33
June	1,720	410	585	1.17	1.30
July	11,600	530	1,680	3.36	3.87
August	3,420	530	1,200	2.40	2.77
September	6,000	490	819	1.64	1.83
October	2,950	490	608	1.22	1.41
November	510	450	485	.970	1.08
December	7,200	470	1,290	2.58	2.97
The year	11,600	215	903	1.81	24.59
1906.					
January	11,400	677	2,160	4.32	4.98
February	1,690	840	1,020	2.04	2.12
March	3,710	840	1,460	2.92	3.37
April	3,330	865	1,230	2.46	2.74
May	3,900	677	986	1.97	2.27
June	6,500	677	1,840	3.68	4.11
July	4,100	815	1,550	3.10	3.57
August	17,100	972	2,900	5.80	6.69
September	5,700	1,340	2,110	4.22	4.71
October	17,000	1,720	3,270	6.54	7.54
November	17,900	1,440	2,520	5.04	5.62
December	6,700	1,120	1,710	3.42	3.94
The year	17,900	677	1,900	3.79	51.60

NOTE. Values are rated as follows: 1905 and 1906, fair; discharge above 4,000 second-feet, approximate.

MISCELLANEOUS MEASUREMENTS IN YADKIN RIVER DRAINAGE BASIN.

The following miscellaneous discharge measurements were made in Yadkin River drainage basin in North Carolina in 1906:

Date.	Stream.	Locality.	Width.	Area of section.	Gage height.	Discharge.
			Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 19	Reddie	North Wilkesboro	70	134	2.60	170
June 21	Mayo	Madison	80	410	2.82	485

INDEX.

A. Page.

Acknowledgments 16
Acre-foot, definition of 4

B.

Basic City, Va.
South River at:
description 63-64
discharge 64
discharge, monthly 65
gage heights 64
rating table 64
Belair, Md.
Little Gunpowder Falls near:
description 42
discharge 42
discharge, monthly 43-44
gage heights 42-43
rating table 43
Binghamton, N. Y.
Chenango River at:
description 27
discharge 27
discharge, monthly 29
gage heights 28
rating table 28
Susquehanna River at:
description 17
discharge 17
discharge, monthly 19
gage heights 18
horsepower 19
rating table 18
Bloomington, Md.
Savage River at:
description 53
discharge 53
discharge, monthly 54-55
gage heights 53
rating table 54
Bolster, R. H., work of 1
Broad Creek at—
Mill Green, Md.:
description 36
discharge 36
discharge, monthly 37
gage heights 36
rating table 37
Buchanan, Va.
James River at:
description 78
discharge 78
discharge, monthly 79

Buchanan, Va.—Continued. Page.
James River at:
gage heights 78
horsepower 79
rating table 79
Buckton, Va.
Passage Creek at:
description 73
discharge 73
gage heights 73-74

C.

Cable station, figure showing 11
Cape Fear River basin:
measurement 88-89
Cartersville, Va.
James River at:
description 80
discharge 81
discharge, monthly 82
gage heights 81
horsepower 82
rating table 81
Chemung River at—
Chemung, N. Y.:
description 29
discharge 29
discharge, monthly 31
gage heights 30
rating table 30
Chenango River at—
Binghamton, N. Y.:
description 27
discharge 27
discharge, monthly 29
gage heights 28
rating table 28
Churchville, Md.
Deer Creek near:
description 37
discharge 38
discharge, monthly 39
gage heights 38
rating table 38
Computation, methods of 13-16
Cooks Creek at
Mount Crawford, Va.:
description 67
discharge 67
discharge, monthly 67-68
gage heights 67
Cooperation, acknowledgments of 16

Cumberland, Md. Page.
Wills Creek at:
description 57
discharge 57
discharge, monthly 58
gage heights 57
rating table 58
Current meters, classes of 10
methods of using 10-11
plate showing 10
Current-meter station, view of 10
Curves (discharge, area, and velocity) figure showing 14

D.

Dan River at—
Madison, N. C.:
description 86
discharge 86
gage heights 86
South Boston, Va.:
description 87
discharge 87
discharge, monthly 88
gage heights 87
horsepower 88
rating table 87
Danville, Pa.
Susquehanna River at:
description 21
discharge 21
discharge, monthly 22
gage heights 21-22
horsepower 22-23
rating table 22
Deer Creek near—
Churchville, Md.:
description 37
discharge 38
discharge, monthly 39
gage heights 38
rating table 38
Definitions of terms used 3-4
Discharge, methods of measuring and computing 13-16
Drainage basins, list of 2-3

E.

Elk Run at—
Elkton, Va.:
description 68
discharge 68
discharge, daily 69
discharge, monthly 70
gage heights 68-69
Elkton, Va.
Elk Run at:
description 68
discharge 68
discharge, daily 69
discharge, monthly 70
gage heights 68-69
Equivalents, table of 6-7

F.

Floats, use of, in measuring discharge 9-10
Follansbee, Robert, work of 1
Frederick, Md. Page.
Monocacy River near:
description 74
discharge 74
discharge, monthly 75
horsepower 76
gage heights 74
rating table 75
Front Royal, Va.
Shenandoah River (South Branch) near:
description 62
discharge 62
discharge, monthly 63
gage heights 62-63
rating table 63

G.

Gaging stations, equipment of 9-10
location of, map showing 2
Georges Creek at—
Westernport, Md.:
description 55
discharge 55
discharge, monthly 56
gage heights 55
rating tables 56
Glencoe, Md.
Gunpowder Falls at:
description 40
discharge 40
discharge, monthly 41-42
gage heights 40
rating tables 41
Great Falls, view of 48
Greensboro, N. C.
South Buffalo Creek at:
discharge 88-89
Grover, N. C., work in charge of 1
Gunpowder Falls at—
Glencoe, Md.:
description 40
discharge 40
discharge, monthly 41-42
gage heights 40
rating tables 41
Gunpowder River basin:
description 39

H.

Harrisburg, Pa.
Susquehanna River at:
description 23
discharge 23
discharge, monthly 24
gage heights 23-24
horsepower 25
rating table 24
Hawksbill Creek near—
Luray, Va.:
description 70
discharge 70
discharge, monthly 71
gage heights 70-71
rating table 71
Henshaw, F. F., work of 1

Page.
Holcomb Rock, Va.
James River at:
description 80
gage heights 80
Hoyt, J. C., work of 1
Hydrographic surveys, organization and scope of 2

I.

Ice-covered streams, method of measuring flow of 13

J.

James River at—
Buchanan, Va.:
description 78
discharge 78
discharge, monthly 79
gage heights 78
horsepower 79
rating table 79
Cartersville, Va.:
description 80
discharge 81
discharge, monthly 82
gage heights 81
horsepower 82
rating table 81
Holcomb Rock, Va.:
description 80
gage heights 80
James River basin:
description 76–78
Juniata River at—
Newport, Pa.:
description 34
discharge 34
discharge, monthly 35
gage heights 34
horsepower 35
rating table 34

L.

Lewis Creek near—
Staunton, Va.:
description 65
discharge 65
discharge, monthly 66
gage heights 65–66
rating table 66
Little Gunpowder Falls near—
Belair, Md.:
description 42
discharge 42
discharge, monthly 43–44
gage heights 42–43
rating table 43
Luray, Va.:
Hawksbill Creek near:
description 70
discharge 70
discharge, monthly 71
gage heights 70–71
rating table 71

M.

McCall Ferry, Pa.
Susquehanna River at:
description 26
discharge, monthly 27
McCall Ferry, Pa.—Continued. Page.
Susquehanna River at:
gage heights 26
rating table 27
Madison, N. C.
Dan River at:
description 86
discharge 86
gage heights 86
Mayo River at:
discharge 94
Martinsburg, W. Va.
Opequon Creek near:
description 58
discharge 58
discharge, monthly 60
gage heights 59
rating table 59
Mayo River at—
Madison, N. C.:
discharge 94
Methods of measuring and computing stream flow, description of 7–16
Mill Green, Md.
Broad Creek at:
description 36
discharge 36
discharge, monthly 37
gage heights 36
rating table 37
Millville, W. Va.
Shenandoah River at:
description 60
discharge 60
discharge, monthly 61
gage heights 60–61
horsepower 62
rating table 61
Miner's inch, definition of 4
Monocacy River near—
Frederick, Md.:
description 74
discharge 74
discharge, monthly 75
gage heights 74
horsepower 76
rating table 75
Mount Crawford, Va.
Cooks Creek at:
description 67
discharge 67
discharge, monthly 67–68
gage heights 67
Multiple-point method of measuring discharge, description of 11–12

N.

Newport, Pa.
Juniata River at:
description 34
discharge 34
discharge, monthly 35
gage heights 34
horsepower 35
rating table 34
North Branch Potomac. *See* Potomac River (North Branch).
North Branch Shenandoah. *See* Shenandoah River (North Branch).

North Wilkesboro, N. C. Page.
Reddie River at:
discharge 94
Yadkin River at:
description 92
discharge 92
discharge, monthly 93
gage heights 92
rating table 93

O.

Opequon Creek near—
Martinsburg, W. Va.:
description 58
discharge 58
discharge, monthly 60
gage heights 59
rating tables 59

P.

Padgett, H. D., work of 1
Passage Creek at—
Buckton, Va.:
description 73
discharge 73
gage heights 73-74
Patapsco River at—
Woodstock, Md.:
description 45
discharge, monthly 46
gage heights 45
horsepower 46
rating table 45
Patapsco River basin:
description 44
Pedee (Yadkin) River basin. *See* Yadkin River.
Piedmont, W. Va.
Potomac River (North Branch) at:
description 48
discharge 48
discharge, montnly 49
gage heights 48
rating table 48
Point of Rocks, Md.
Potomac River at:
curves at, figure showing 14
description 49
discharge 49
discharge, monthly 51
gage heights 50
horsepower 51
rating table 50
Potomac River at—
Point of Rocks, Md.:
curves at, figure showing 14
description 49
discnarge 49
discharge, monthly 51
gage heights 50
horsepower 51
rating table 50
Potomac River (North Branch) at—
Piedmont, W. Va.:
description 48
discharge 48
discharge, monthly 49

Potomac River (North Branch) at—Con. Page.
Piedmont, W. Va.:
gage heights 48
rating table 49
Potomac River (South Branch) near—
Springfield, W. Va.:
description 51-52
discharge 52
discharge, monthly 53
gage heights 52
rating table 53
Potomac River basin:
description 46-48
Power-plant construction, views of 16
Price current meter, views of 10

R.

Randolph, Va.
Roanoke River at:
description 85
discharge 85
gage heights 85-86
Rating tables, methods of construction of 13-15
Reddie River at—
North Wilkesboro, N. C.:
discharge 94
Riverton, Va.
North Branch Shenandoah River near:
description 72
discharge 72
discharge, monthly 73
gage heights 72
rating table 72
Roanoke River at—
Randolph, Va.:
description 85
discharge 85
gage heights 85-86
Roanoke, Va.:
description 83
discharge 83
discharge, monthly 84
gage heights 83-84
horsepower 85
rating table 84
Roanoke River basin:
description 82-83
Run-off, computation of 13-16
Run-off in inches, definition of 4

S.

Salisbury, N. C.
Yadkin River near:
description 90-91
discharge 91
discharge, monthly 92
gage heights 91
rating table 92
Savage River at—
Bloomington, Md.:
description 53
discharge 53
discharge, monthly 54-55
gage heights 53
rating table 54
Second-foot, definition of 4
Second-feet per square mile, definition of 4

Page.

Shenandoah River at—
Millville, W. Va.:
description 60
discharge 60
discharge, monthly 61
gage heights 60-61
horsepower 62
rating table 61
Shenandoah River (North Branch) near—
Riverton, Va.:
description 72
discharge 72
discharge, monthly 73
gage heights 72
rating table 72
Shenandoah River (South Branch) near—
Front Royal, Va.:
description 62
discharge 62
discharge, monthly 63
gage heights 62-63
rating table 63
Single-point method of measuring discharge, description of 12
Slope method of measuring discharge, description of 7-8
South Boston, Va.
Dan River at:
description 87
discharge 87
discharge, monthly 88
gage heights 87
horsepower 88
rating table 87
South Branch Potomac. *See* Potomac River (South Branch).
South Branch Shenandoah. *See* Shenandoah River (South Branch).
South Buffalo Creek near—
Greensboro, N. C.:
discharge 88-89
South River at—
Basic City, Va.:
description 63-64
discharge 64
discharge, monthly 65
gage heights 64
rating table 64
Springfield, W. Va.
South Branch Potomac River near:
description 51-52
discharge 52
discharge, monthly 53
gage heights 52
rating table 53
Staunton, Va.
Lewis Creek near:
description 65
discharge 65
discharge, monthly 66
gage heights 65-66
rating tables 66
Stewart, J. E., work of 1
Stream flow, methods of measuring and computing 7-13
papers on, list of 3
Surface water supply, papers on, list of 2-3

Page.

Susquehanna River at—
Binghamton, N. Y.:
description 17
discharge 17
discharge, monthly 19
gage heights 18
horsepower 19
rating table 18
Danville, Pa.:
description 21
discharge 21
discharge, monthly 22
gage heights 21-22
horsepower 22-23
rating table 22
Harrisburg, Pa.:
description 23
discharge 23
discharge, monthly 24
gage heights 23-24
horsepower 25
rating table 24
McCall Ferry, Pa.:
description 26
discharge, monthly 27
gage heights 26
rating table 27
Wilkesbarre, Pa.:
description 19-20
discharge 20
discharge, monthly 21
gage heights 20
rating table 20
Susquehanna River (West Branch) at—
Williamsport, Pa.:
description 31
discharge 31
discharge, monthly 33
gage heights 32
horsepower 33
rating table 32
Susquehanna River basin:
description of 16-17

T.

Tables, explanations and use of 4-6

V.

Velocity methods of measuring discharge, description of 9-13
Vertical integration method of measuring discharge, description of 12

W.

Water supply, surface, papers on, list of ... 2-3
Weir method of measuring discharge, description of 8-9
West Branch Susquehanna. *See* Susquehanna River (West Branch).
Westernport, Md.
Georges Creek at:
description 55
discharge 55
discharge, monthly 56
gage heights 55
rating tables 56

Wilkesbarre, Pa. Page.
Susquehanna River at:
description 19-20
discharge 20
discharge, monthly 21
gage heights 20
rating table 20
Williamsport, Pa.
Susquehanna River (West Branch) at:
description 31
discharge 31
discharge, monthly 33
gage heights 32
horsepower 33
rating table 32
Wills Creek at
Cumberland, Md.:
description 57
discharge 57
discharge, monthly 58
gage heights 57
rating table 58
Woodstock, Md. Page.
Patapsco River at:
description 45
discharge, monthly 46
gage heights 45
horsepower 46
rating table 45

Y.

Yadkin River at—
North Wilkesboro, N. C.:
description 92
discharge 92
discharge, monthly 93
gage heights 92
rating table 93
Salisbury, N. C.:
description 90-91
discharge 91
discharge, monthly 92
gage heights 91
rating table 92
Yadkin (Pedee) River basin:
description 89-90

CLASSIFICATION OF THE PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

[Water-Supply Paper No. 203.]

The publications of the United States Geological Survey consist of (1) Annual Reports, (2) Monographs, (3) Professional Papers, (4) Bulletins, (5) Mineral Resources, (6) Water-Supply and Irrigation Papers, (7) Topographic Atlas of United States—folios and separate sheets thereof, (8) Geologic Atlas of United States—folios thereof. The classes numbered 2, 7, and 8 are sold at cost of publication; the others are distributed free. A circular giving complete lists can be had on application.

Most of the above publications can be obtained or consulted in the following ways:

1. A limited number are delivered to the Director of the Survey, from whom they may be obtained, free of charge (except classes 2, 7, and 8), on application.

2. A certain number are delivered to Senators and Representatives in Congress, for distribution.

3. Other copies are deposited with the Superintendent of Documents, Washington, D. C., from whom they can be had at practically cost.

4. Copies of all Government publications are furnished to the principal public libraries in the large cities throughout the United States, where they can be consulted by those interested.

The Professional Papers, Bulletins, and Water-Supply Papers treat of a variety of subjects, and the total number issued is large. They have therefore been classified into the following series: A, Economic geology; B, Descriptive geology; C, Systematic geology and paleontology; D, Petrography and mineralogy; E, Chemistry and physics; F, Geography; G, Miscellaneous; H, Forestry; I, Irrigation; J, Water storage; K, Pumping water; L, Quality of water; M, General hydrographic investigations; N, Water power; O, Underground waters; P, Hydrographic progress reports.

Series P.—The hydrographic progress reports contain the results of stream measurements. A report is issued for every calendar year, containing the results of data collected during that year. These reports were first published as a part of the Director's annual report or as a bulletin; they are now published as water-supply and irrigation papers. The following is a list, by years, of the publications containing the progress reports of stream measurements (* means out of stock). A detailed index of these reports (1888–1903) is published as Water-Supply Paper No. 119.

1888. Tenth Annual Report, Part II.*
1889. Eleventh Annual Report, Part II.*
1890. Twelfth Annual Report, Part II.*
1891. Thirteenth Annual Report, Part III.*
1892. Fourteenth Annual Report, Part II.*
1893. Bulletin No. 131.*
1894. Bulletin No. 131;* Sixteenth Annual Report, Part II.*
1895. Bulletin No. 140.*
1896. Water-Supply Paper No. 11;* Eighteenth Annual Report, Part IV.*
1897. Water-Supply Papers Nos. 15* and 16;* Nineteenth Annual Report, Part IV.*
1898. Water-Supply Papers Nos. 27* and 28;* Twentieth Annual Report, Part IV.*
1899. Water-Supply Papers Nos. 35,* 36,* 37,* 38,* and 39;* Twenty-first Annual Report, Part IV.*
1900. Water-Supply Papers Nos. 47, 48, 49, 50, 51, and 52; Twenty-second Annual Report, Part IV.
1901. East of Mississippi River, Water-Supply Papers Nos. 65* and 75.*
West of Mississippi River, Water-Supply Papers Nos. 66 and 75.*

1902. East of Mississippi River, Water-Supply Papers Nos. 82 and 83.
West of Mississippi River, Water-Supply Papers Nos. 84 and 85.
1903. East of Mississippi River, Water-Supply Papers Nos. 97 and 98.
West of Mississippi River, Water-Supply Papers Nos. 99 and 100.
1904. East of Mississippi River, Water-Supply Papers Nos. 124, 125, 126, 127, 128, and 129.
West of Mississippi River, Water-Supply Papers Nos. 130, 131, 132, 133, 134, and 135.
1905. East of Mississippi River, Water-Supply Papers Nos. 165,* 166,* 167, 168,* 169, 170, and 171.
West of Mississippi River, Water-Supply Papers Nos. 171, 172,* 173,* 174, 175,* 176, 177, and 178.
1906. East of Mississippi River, Water-Supply Papers Nos. 201, 202, 203, 204, 205, 206, and 207.
West of Mississippi River, Water-Supply Papers Nos. 207, 208, 209, 210, 211, 212, 213, and 214.

Correspondence should be addressed to

THE DIRECTOR,
UNITED STATES GEOLOGICAL SURVEY,
WASHINGTON, D. C.

JULY, 1907.

O

Water-Supply and Irrigation Paper No. 204 Series P, Hydrographic Progress Reports, 58

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

SURFACE WATER SUPPLY OF SOUTHERN ATLANTIC AND EASTERN GULF STATES, 1906

(SANTEE, SAVANNAH, OGEECHEE, AND ALTAMAHA RIVERS AND EASTERN GULF OF MEXICO DRAINAGES)

M. R. HALL
DISTRICT HYDROGRAPHER

WASHINGTON
GOVERNMENT PRINTING OFFICE
1907

CONTENTS.

	Page.
Introduction	1
Scope of work	1
Definitions	3
Explanation and use of tables	4
Convenient equivalents	6
Field methods of measuring stream flow	7
Office methods of computing run-off	13
Cooperation and acknowledgments	15
Southern Atlantic States drainages	17
Santee River drainage basin	17
Description of basin	17
Catawba River near Morganton, N. C	19
Catawba River survey	20
Wateree River near Camden, S. C	20
Broad River (of the Carolinas) at Alston, S. C	22
Broad River survey	23
Miscellaneous measurements	24
Savannah River drainage basin	24
Description of basin	24
Tallulah River at Tallulah Falls, Ga	25
Tugaloo River near Madison, S. C	27
Savannah River at Woodlawn, S. C	28
Savannah River at Augusta, Ga	30
Broad River (of Georgia) near Carlton, Ga	32
Miscellaneous measurements	33
Ogeechee River drainage basin	34
Description of basin	34
Cannoochee River near Groveland, Ga	34
Altamaha River drainage basin	36
Description of basin	36
Ocmulgee River near Jackson, Ga	37
Ocmulgee River at Macon, Ga	39
Alcovy River near Stewart, Ga	40
Apalachee River near Buckhead, Ga	42
Oconee River near Greensboro, Ga	43
Oconee River at Fraleys Ferry, near Milledgeville, Ga	45
Oconee River at Dublin, Ga	46
Ohoopee River near Reidsville, Ga	48
St. Johns River drainage basin	50
Silver Springs at Silver Springs, Fla	50

Page.
Eastern Gulf States drainages 51
Withlacoochee River (Florida) drainage basin 51
Miscellaneous measurement 51
Suwanee River drainage basin 51
Description of basin 51
Suwanee River at White Springs, Fla 51
Miscellaneous measurements 52
Apalachicola River drainage basin 53
Description of basin 53
Chattahoochee River near Norcross, Ga 54
Chattahoochee River at West Point, Ga 55
Soque River near Demorest, Ga 57
Flint River near Woodbury, Ga 58
Flint River near Montezuma, Ga 60
Flint River at Albany, Ga 61
Kinchafoonee Creek near Leesburg, Ga 63
Ichawaynochaway Creek at Milford, Ga 65
Miscellaneous measurements 67
Choctawhatchee River drainage basin 68
Description of basin 68
Choctawhatchee River near Newton, Ala 68
Pea River at Elba, Ala 70
Pea River at Pera, Ala 71
Miscellaneous measurements 72
Escambia River drainage basin 73
Description of basin 73
Conecuh River at Beck, Ala 73
Miscellaneous measurement 75
Mobile River drainage basin 75
Description of basin 75
Alabama River at Selma, Ala 75
Etowah River near Rome, Ga 77
Coosa River at Riverside, Ala 79
Oostanaula River at Resaca, Ga 81
Coosawattee River at Carters, Ga 83
Choccolocco Creek near Jenifer, Ala 84
Tallapoosa River at Sturdevant, Ala 86
Tallapoosa River survey 87
Cahaba River at Centerville, Ala 87
Tombigbee River at Columbus, Miss 89
Tombigbee River at Epes, Ala 90
Black Warrior River near Cordova, Ala 92
Miscellaneous measurements 94
Pearl River drainage basin 98
Description of basin 98
Pearl River at Jackson, Miss 99
Bogue Chitto at Warnerton, La 100
Lake Pontchartrain drainage basin 101
Miscellaneous measurements 101
Index 103

ILLUSTRATIONS.

		Page.
PLATE I.	Map of United States, showing location of principal river stations maintained during 1906	2
II.	*A*, Price current-meters; *B*, Current-meter rating station, Los Angeles, Cal	10
III.	*A*, Atlanta Water and Electric Power Company plant on Chattahoochee River at Bull Sluice, above Atlanta, Ga.; *B*, North Georgia Electric Power Company plant on Chattahoochee River near Gainesville, Ga	54
IV.	*A*, Dam and power house of Montgomery Power Company on Tallapoosa River above Tallassee, Ala.; *B*, Interior of power house of Montgomery Power Company on Tallapoosa River above Tallassee, Ala	86
V.	Canal power house and mills of Tallassee Falls Manufacturing Company on Tallapoosa River at Tallassee, Ala	88
FIG. 1.	Cable station, showing section of river, car, gage, etc	11
2.	Typical discharge, area, and mean-velocity curves for Potomac River at Point of Rocks, Md	15

SURFACE WATER SUPPLY OF THE SOUTHERN ATLANTIC AND EASTERN GULF STATES, 1906.[a]

M. R. HALL,
District hydrographer.[b]

INTRODUCTION.

SCOPE OF WORK.

The water supply of the United States is of more importance to the life and pursuits of the people than is any other natural resource. In the arid States the limit of agricultural development is determined by the amount of water available for irrigation; while in all parts of the country the increase in the population of cities and towns makes necessary additional water supplies for domestic and industrial uses, in procuring which both the quantity and the quality of the water that may be obtained must be considered. The location of manufacturing plants may depend largely on the water-power facilities and on the character of the water. The notable advances made in the electric transmission of power have led to the utilization of water powers for the operation of manufacturing establishments, railroads, and municipal lighting plants, many of which are at some distance from the places at which the power is developed.

The intelligent establishment and maintenance of enterprises or industries that depend on the use of water demands a thorough knowledge of the flow of the streams and an understanding of the conditions affecting that flow. This knowledge should be based on data showing both the total flow and the distribution of the flow throughout the year, in order that normal fluctuations may be provided for. As the flow of a stream is variable from year to year

[a] This report contains information similar to that published in previous years under the title "Report on Progress of Stream Measurements."

[b] The data in this report have been collected under the direction of M. R. Hall, district hydrographer, assisted by W. E. Hall and F. A. Murray.

The data have been prepared for publication under the direction of John C. Hoyt, by R. H. Bolster, Robert Follansbee, F. F. Henshaw, J. E. Stewart, and H. D. Padgett.

estimates of future flow can be made only from a study of ob tions covering several years. The rapid increase in the develo of the water resources of the United States has caused a great d by engineers for information in regard to the flow of streams, now generally realized that the failure of many large power, tion, and other projects has been due to the fact that the plan made without sufficient trustworthy information in respect water supply.

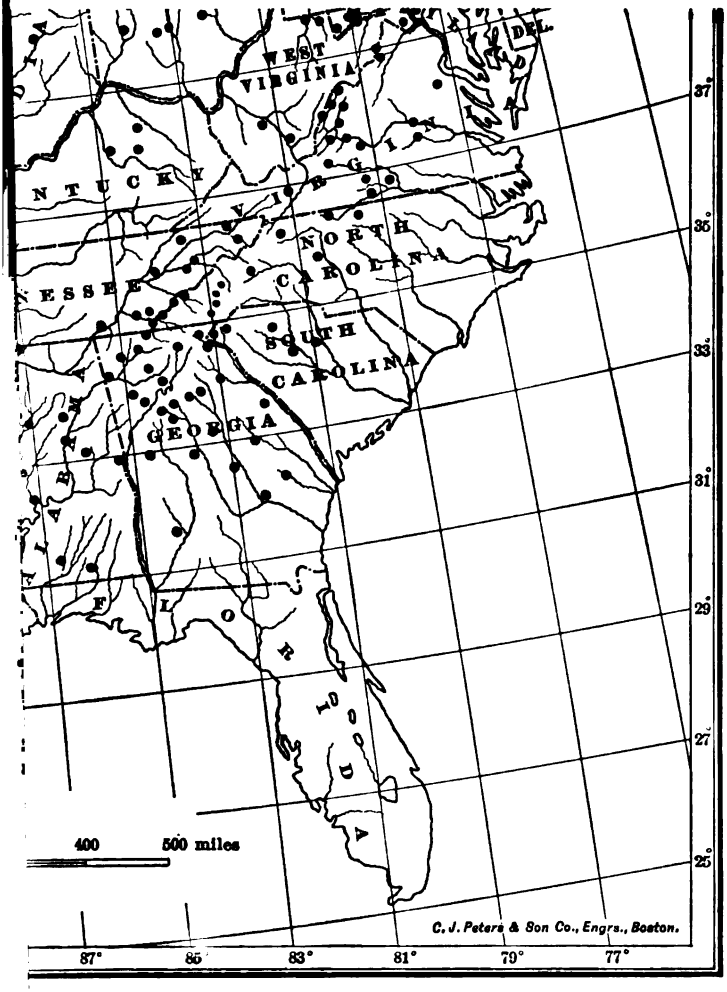
Owing to the broad scope of these hydrographic investigatio the length of time they should cover in order that the record be of greatest value, it is in general impossible for private indiv to collect the necessary data, and as many of the streams tr more than one State this work does not properly fall with province of the State authorities. The United States Geo Survey has therefore, by means of specific appropriations by gress, for several years systematically made records of stream with the view of ultimately determining all the important fe governing the flow of the principal streams of the country. rying out this plan stations are established on the streams and tained for a period long enough to show their regimen or g behavior. When a record that is sufficient for this purpose ha obtained for any stream the work on that stream is discont The order in which the streams are measured is determined degree of their importance.

During 1906 the regimen of flow was studied at about 700 sta distributed along the various rivers throughout the United Stat shown on Pl. I. In addition to these records data in regard to cipitation, evaporation, water power, and river profiles were obt in many sections of the country.

These data have been assembled by drainage areas, and are lished in a series of fourteen Water-Supply and Irrigation Pa Nos. 201 to 214, inclusive, each of which pertains to the surface w resources of a group of adjacent areas. In these papers are embo not only the data collected in the field, but also the results of c putations based on these data, and other information that h direct bearing on the subject, such as descriptions of basins and streams draining them, utility of the water resources, etc. The follows:

Water-Supply and Irrigation Papers on Surface Water Supply, 1906.

201. Surface water supply of New England, 1906 (Atlantic coast of New Eng drainage).
202. Surface water supply of the Hudson, Passaic, Raritan, and Delaware river dr ages, 1906.


WEST VIRGINIA
DEL.
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
FLORIDA
400
500 miles
C. J. Peters & Son Co., Engrs., Boston.
37°
35°
33°
31°
29°
27°
25°
87°
85°
83°
81°
79°
77°

URING 1906.

203. Surface water supply of the Middle Atlantic States, 1906. (Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages.)
204. Surface water supply of the Southern Atlantic and Eastern Gulf States, 1906. (Santee, Savannah, Ogeechee, and Altamaha rivers and eastern Gulf of Mexico drainages.)
205. Surface water supply of the Ohio and lower eastern Mississippi river drainages, 1906.
206. Surface water supply of the Great Lakes and St. Lawrence River drainages, 1906.
207. Surface water supply of the upper Mississippi River and Hudson Bay drainages, 1906.
208. Surface water supply of the Missouri River drainage, 1906.
209. Surface water supply of the lower western Mississippi River drainage, 1906.
210. Surface water supply of the western Gulf of Mexico and Rio Grande drainages, 1906.
211. Surface water supply of the Colorado River drainage above Yuma, 1906.
212. Surface water supply of the Great Basin drainage, 1906.
213. Surface water supply of California, 1906. (The Great Basin and Pacific Ocean drainages in California, and Colorado River drainage below Yuma.)
214. Surface water supply of the North Pacific Coast drainage, 1906.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing such records up to and including 1903 has been published in Water-Supply Paper No. 119. The following table gives, by years and primary drainage basins, the numbers of the papers on surface water supply published from 1901 to 1906:

Numbers of Water-Supply Papers containing results of stream measurements, 1901–1906.[a]

	1901.	1902.	1903.	1904.	1905.	1906.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
Atlantic coast of New England drainage	65 75	82	97	124	165	201
Hudson, Passaic, Raritan, and Delaware rivers drainages	65 75	82	97	125	166	202
Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages	65 75	82 83	97 98	126	167	203
Santee, Savannah, Ogeechee, and Altamaha rivers, and eastern Gulf of Mexico drainages	65 75	83	98	127	168	204
Ohio and lower eastern Mississippi river drainages	65 75	83	98	128	169	205
Great Lakes and St. Lawrence River drainages	65	83	97	129	170	206
Hudson Bay and upper eastern and western Mississippi River drainages	65 66 75	83 84 85	98 99 100	128 130	171	207
Missouri River drainage	66 75	84	99	130 131	172	208
Meramec, Arkansas, Red, and lower western Mississippi river drainages	66 75	84	99	131	173	209
Western Gulf of Mexico and Rio Grande drainages	66 75	84	99	132	174	210
Colorado River drainage above Yuma	66 75	85	100	133	175	211
The Great Basin drainage	66 75	85	100	133	176	212
The Great Basin and Pacific Ocean drainages in California, and Colorado River drainage below Yuma	66 75	85	100	134	177	213
North Pacific Coast drainage	66 75	85	100	135	178	214

[a] Reports containing data for years prior to 1901 are noted in the series list at the end of this paper.

DEFINITIONS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet per square mile, and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second, and is the quantity of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the quantity of water that passes through an orifice 1 inch square under a head which varies locally. It has been commonly used by miners and irrigators throughout the West, and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

"Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work. There is a convenient relation between the second-foot and the acre-foot: One second-foot flowing for twenty-four hours will deliver 86,400 cubic feet, or approximately 2 acre-feet.

EXPLANATION AND USE OF TABLES.

For each regular gaging station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of monthly and yearly discharges and run-off.

6. Tables showing discharge and horsepower and the number of days during the year when the same are available.

The descriptions of stations give such general information about the locality and equipment as would enable the reader to find and use the station, and they also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, the name of the hydrographer, the width and area of cross section, the gage height, and the discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. At most stations the gage is read in the morning and in the evening.

The discharge measurements and gage heights are the base data from which the other tables are computed. In cases of extensive development it is expected that engineers will use these original data in making their calculations, as the computations made by the Survey are based on the data available at the time they are made and should be reviewed and, if necessary, revised when additional data are available.

The rating table gives the discharge in second-feet corresponding to various stages of the river as given by the gage heights. It is published to enable engineers to determine the daily discharge in case this information is desired.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow for each second during the month. Upon this the computations for the remaining columns, which are defined on page 4, are based.

The values in the table of monthly discharge are intended to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates.

In most work where data in regard to flow are used the regimen of flow is of primary importance. Therefore for the principal stations tables have been prepared showing the horsepower that can be

developed at various rates of flow, and the length of time that these rates of flow and the corresponding horsepower are available. These tables have been prepared on a basis of 80 per cent efficiency on the turbines, and the horsepower per foot of fall is given in order that the reader can determine the horsepower for any fall.

In the computations, sufficient significant figures have been used so that the percentage of error in the tables will not in general exceed 1 per cent. Therefore, most of the values in the tables are given to only three significant figures. In making the various computations, Thatcher's slide rule, Crelle's tables, and computation machines have been generally used.

In order to give engineers an idea of the relative value of the various data, notes in regard to accuracy are given as far as possible. This accuracy depends on the general local conditions at the gaging stations and the amount of data collected. Every effort possible is made to so locate the stations that the data collected will give a high degree of accuracy. This is not always possible, but it is considered better to publish rough values with explanatory notes rather than no data.

In the accuracy notes the following terms have been used, indicating the probable accuracy, in per cent, of the mean monthly flow. As these values are mean values, the error in the value for the flow of any individual day may be much larger.

Excellent indicates that the mean monthly flow is probably accurate to within 5 per cent; good, to within 10 per cent; fair, to within 15 per cent; approximate, to within 25 per cent.

CONVENIENT EQUIVALENTS.

Following is a table of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet, or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile .03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second-foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.

1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equal 15.7 United States gallons per second.
100 California miner's inches equal 96.0 Colorado miner's inches.
100 California miner's inches for one day equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 104 California miner's inches.
100 Colorado miner's inches for one day equal 5.17 acre-feet.
100 United States gallons per minute equal 0.223 second-foot.
100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5.280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1½ horsepower equal about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water-wheel, realizing 80 per cent of theoretical power.

FIELD METHODS OF MEASURING STREAM FLOW.

The methods used in collecting these data and in preparing them for publication are given in detail in Water-Supply Papers No. 94 (Hydrographic Manual, U. S Geological Survey) and No. 95 (Accuracy of Stream Measurements). In order that those who use this report may readily become acquainted with the general methods employed, the following brief descriptions are given:

Streams may be divided, with respect to their physical conditions, into three classes: (1) Those with permanent beds; (2) those with beds which change only during extreme low or high water; (3) those with constantly shifting beds. In determining the daily flow, special methods are necessary for each class. The data upon which these

determinations are based and the method of collecting them are, however, in general the same.

There are three distinct methods of determining the flow of open-channel streams: (1) By measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir; (3) by measurements of the velocity of the current and the area of the cross section. The method chosen for any case depends upon the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to the coefficients to be used in the Chezy formula, $v=c\sqrt{Rs}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The results obtained by the slope method are, in general, only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the values for n to be used in Kutter's formula. The most common use of this method is in estimating the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions.

Weir method.—When funds are available and the conditions are such that sharp-crested weirs can be erected, these offer the best facilities for determining the flow. If dams are suitably situated and constructed, they may be utilized for obtaining reliable measurements of flow. The conditions necessary to insure good results may be divided into two classes—(1) those relating to the physical characteristics of the dam itself, and (2) those relating to the diversion and use of water around and through the dam.

The physical requirements are as follows: (*a*) Sufficient height of dam, so that backwater will not interfere with free fall over it; (*b*) absence of leaks of appreciable magnitude; (*c*) topography or abutments which confine the flow over the dam at high stages; (*d*) level crests which are kept free from obstructions caused by floating logs or ice; (*e*) crests of a type for which the coefficients to be used in $Q=c\,b\,h^{\frac{3}{2}}$, or some similar standard weir formula, are known (see Water-Supply Papers Nos. 180 and 200[a]); (*f*) either no flashboards or exceptional care in reducing leakage through them and in recording their condition.

Preferably there should be no diversion of water through or around the dam. Generally, however, the dam is built for purposes of power or navigation, and part or all of the water flowing past it is diverted for such uses. This water is measured and added to that passing over the dam. To insure accuracy in such determinations of

[a] Water-Supply Paper No. 200 replaces No. 150, the edition of which has been exhausted.

flow, the amount of water diverted should be reasonably constant. Furthermore, it should be so diverted that it can be measured, either by a weir, a current meter, or a simple system of water wheels which are of standard make or which have been rated as meters under working conditions and so installed that the gate openings, the heads under which they work, and their angular velocities may be accurately observed.

The combination of physical conditions and uses of the water should be such that the determinations of flow will not involve, for a critical stage of considerable duration, the use of a head on a broad-crested dam of less than 6 inches. Moreover, when all other conditions are good the cooperation of the owners or operators of the plant is still essential if reliable results are to be obtained.

A gaging station at a weir or dam has the general advantage of continuity of record through the period of ice and floods and the disadvantages of uncertainty of coefficient to be used in the weir formula and of complications in the diversion and use of the water.

Velocity method.—The determination of the quantity of water flowing past a certain section of a stream at a given time is termed a discharge measurement. This quantity is the product of two factors—the mean velocity and the area of the cross section. The mean velocity is a function of surface slope, wetted perimeter, roughness of bed, and the channel conditions at, above, and below the gaging section. The area depends on the contour of the bed and the fluctuations of the water surface. The two principal ways of measuring the velocity of a stream are by floats and current meters.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements, in order that the data may have the required degree of accuracy. Their essential requirements are practically the same, whether the velocity is determined by meters or floats. They are located as far as possible where the channel is straight both above and below the gaging section; where there are no cross currents, backwater, or boils; where the bed of the stream is reasonably free from large projections of a permanent character, and where the banks are high and subject to overflow only at flood stages. The station must be so far removed from the effects of tributary streams and of dams or other artificial obstructions that the gage height shall be an index of the discharge.

Certain permanent or semipermanent structures, usually referred to as equipment, are generally pertinent to a gaging station. These are a gage for determining the fluctuations of the water surface, bench marks to which the datum of the gage is referred, permanent marks on a bridge or a tagged line indicating the points of measurement, and where the current is swift some appliance (generally a secondary

cable) to hold the meter in position in the water. As a rule the stations are located at bridges if the channel conditions are satisfactory, as from them the observations can more readily be made and the cost of the equipment is small.

The floats in common use are the surface, subsurface, and tube or rod floats. A corked bottle with a flag in the top and weighted at the bottom makes one of the most satisfactory surface floats, as it is affected but little by wind. In case of flood measurements good results can be obtained by observing the velocity of floating cakes of ice or débris. In case of all surface-float measurements coefficients must be used to reduce the observed velocity to the mean velocity. The subsurface and tube or rod floats are intended to give directly the mean velocity in the vertical. Tubes give excellent results when the channel conditions are good, as in canals.

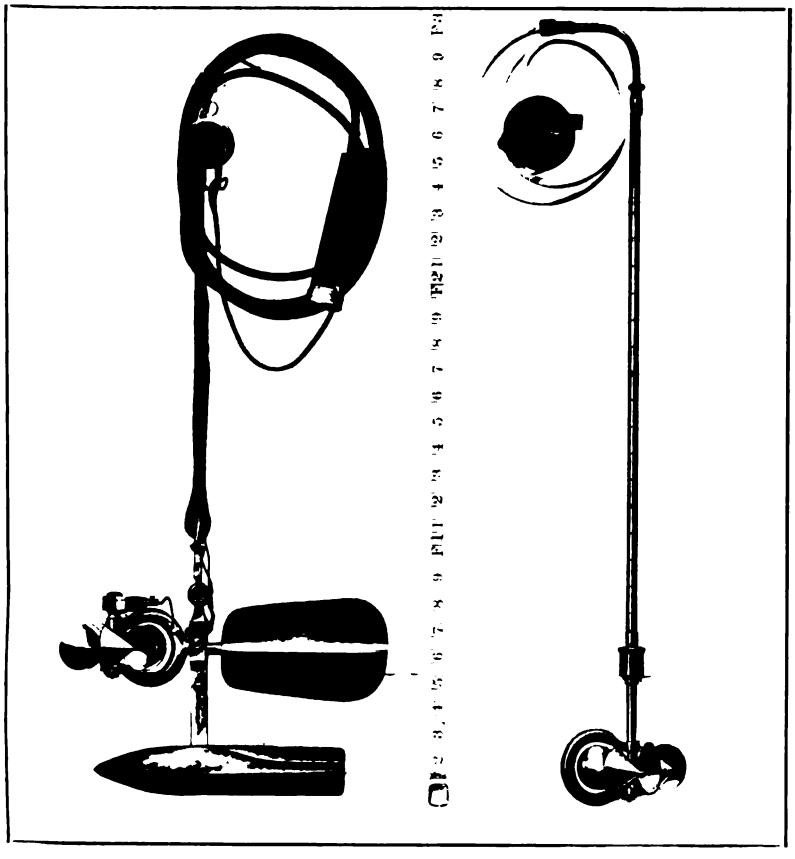
In measuring velocity by a float, observation is made of the time taken by the float to pass over the "run," a selected stretch of river from 50 to 200 feet long. In each discharge measurement a large number of velocity determinations are made at different points across the stream, and from these observations the mean velocity for the whole section is determined. This may be done by plotting the mean positions of the floats, as indicated by the distances from the bank, as ordinates, and the corresponding times as abscissas. A curve through these points shows the mean time of run at any point across the stream, and the mean time for the whole stream is obtained by dividing the area bounded by this curve and its axis by the width. The length of the run divided by the mean time gives the mean velocity.

The area used in float measurements is the mean of the areas at the two ends of the run and at several intermediate sections.

The essential parts of the current meters in use are a wheel of some type, so constructed that the impact of flowing water causes it to revolve, and a device for recording or indicating the number of revolutions. The relation between the velocity of the moving water and the revolutions of the wheel is determined for each meter. This rating is done by drawing the meter through still water for a given distance at different speeds, and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity per second for any number of revolutions.

Many kinds of current meters have been constructed. They may, however, be classed in two general types: Those in which the wheel is made up of a series of cups, as the Price, and those having a screw propeller wheel, as the Haskell. Each meter has been developed for use under some special condition. In the case of the small Price meter, shown in Pl. II, *B*, which has been largely developed and extensively used by the United States Geological Survey, an attempt

A. CURRENT-METER RATING STATION AT LOS ANGELES, CAL.



B. PRICE CURRENT METERS.

has been made to get an instrument which could be used under practically all conditions.

Current-meter measurements may be made from a bridge, a cable, a boat, or by wading, and gaging stations may be classified in accordance with such use. Fig. 1 shows a typical cable station.

In making the measurement an arbitrary number of points are laid off on a line perpendicular to the thread of the stream. The points at which the velocity and depth are observed are known as measuring points, and are usually fixed at regular intervals, varying from 2 to 20 feet, depending upon the size and condition of the stream. Perpendiculars dropped from the measuring points divide the gaging section into strips. For each strip or pair of strips the mean velocity, area, and discharge are determined independently, so that conditions existing in one part of the stream may not be extended to parts where they do not apply.

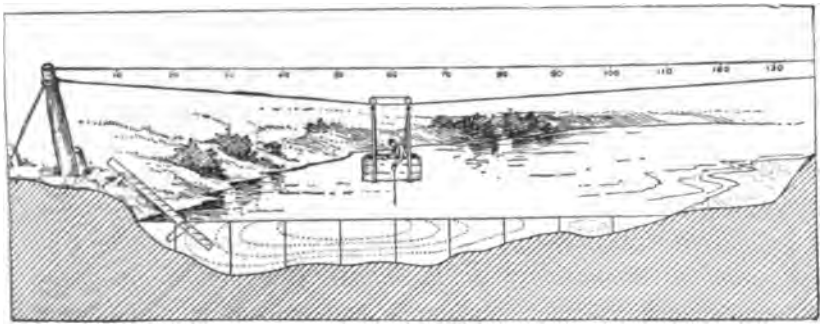


FIG. 1.—Cable station, showing section of river, car, gage, etc.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

The three principal multiple-point methods in general use are the vertical velocity-curve; 0.2 and 0.8 depth; and top, bottom, and mid-depth.

In the vertical velocity-curve method a series of velocity determinations are made in each vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve among the resulting points, the vertical velocity-curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity-curve and its axis by the depth. On account of the length of time required to make a complete measurement by this method its use is limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 of the depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity-curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 of the depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this second multiple-point method gives the mean velocity very closely for open-water conditions, and moreover the indications are that it holds nearly as well for ice-covered rivers.

In the third multiple-point method the meter is held at mid-depth, at 0.5 foot below the surface, and at 0.5 foot above the bottom, and the mean velocity is determined by dividing by 6 the sum of the top velocity, 4 times the mid-depth velocity, and the bottom velocity. This method may be modified by observing at 0.2, 0.6, and 0.8 depth.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined.

Extensive experiments by vertical velocity-curves show that the thread of mean velocity generally occurs at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, at which point the meter is held in a majority of the measurements. A large number of vertical velocity-curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be from 0.85 to 0.95, depending upon the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is specially adapted for flood measurements or when the velocity is so great that the meter can not be kept at 0.6 depth.

The vertical-integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods.

The area, which is the other factor in the velocity method of determining the discharge of a stream, depends on the stage of the river,

which is observed on the gage, and on the general contour of the bed of the stream, which is determined by soundings. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable or by a special sounding line or rod. For streams with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also of value in obtaining the area for use in computations of high-water measurements, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at various points of measurement the measuring section is divided into elementary strips, as shown in fig. 1, and the mean velocity, area, and discharge are determined separately for either a single or a double strip. The total discharge and the area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8, and vertical velocity-curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, the thickness and character of the ice, etc. From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice. For information in regard to flow under ice cover see Water-Supply Paper No. 187.

OFFICE METHODS OF COMPUTING RUN-OFF.

There are two principal methods of determining run-off, depending upon whether or not the bed of the stream is permanent.

For stations of streams with permanent beds the first step in computing the run-off is the construction of a rating table, which shows the discharge corresponding to any stage of the stream. This rating table is applied to the record of stage to determine the amount of water flowing. The construction of the rating table depends upon the method used in measuring flow.

For a station at a weir or dam the basis for the rating table is some standard weir formula. The coefficients to be used in its application

depend upon the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and assumed coefficient the discharge is computed for various heads and the rating table constructed.

The data necessary for the construction of a rating table for a velocity-area station are the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross section, the mean velocity of the current, and the quantity of water flowing. A thorough knowledge of the conditions at and in the vicinity of the station is also necessary.

The construction of the rating table depends upon the following laws of flow for open permanent channels: (1) The discharge will remain constant so long as conditions at or near the gaging station remain constant. (2) The discharge will be the same whenever the stream is at a given stage if the change of slope due to the rise and fall of the stream be neglected. (3) The discharge is a function of and increases gradually with the stage.

The plotting of results of the various discharge measurements, using gage heights as ordinates, and discharge, mean velocity, and area as abscissas, will define curves which show the discharge, mean velocity, and area corresponding to any gage height. For the development of these curves there should be, therefore, a sufficient number of discharge measurements to cover the range of the stage of the stream. Fig. 2 shows a typical rating curve with its corresponding mean-velocity and area curves.

As the discharge is the product of two factors, the area and the mean velocity, any change in either factor will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is always concave toward the horizontal axis or on a straight line, unless the banks of the stream are overhanging.

The form of the mean-velocity curve depends chiefly upon the surface slope, the roughness of the bed, and the cross section of the stream. Of these the slope is the principal factor. In accordance with the relative changes of these factors the curve may be either a straight line, convex or concave toward either axis, or a combination of the three. From a careful study of the conditions at any gaging station the form which the vertical velocity-curve will take can be predicted, and it may be extended with reasonable certainty to stages beyond the limits of actual measurements. Its principal use is in connection with the area curve in locating errors in discharge measurements and in constructing the rating table.

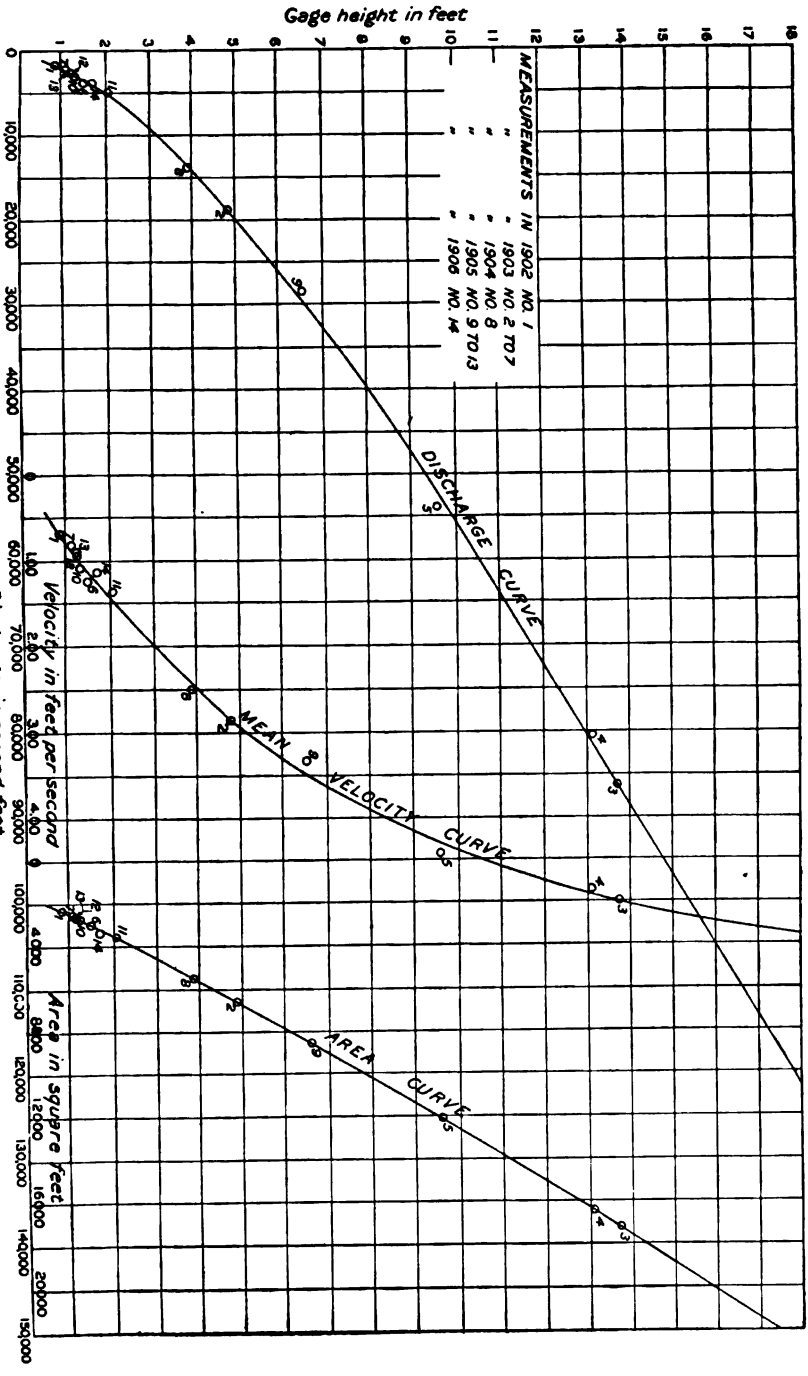


FIG. 2.—Discharge, area, and mean-velocity curves for Potomac River at Point of Rocks, Md.

The discharge curve is defined primarily by the measurements of discharge, which are studied and weighted in accordance with the local conditions existing at the time of each measurement. The curve may, however, best be located between and beyond the measurements by means of curves of area and mean velocity. The discharge curve under normal conditions is concave toward the horizontal axis and is generally parabolic in form.

In the preparation of the rating table the discharge for each tenth or half tenth on the gage is taken from the curve. The differences between successive discharges are then taken and adjusted according to the law that they shall either be constant or increasing.

The determination of daily discharge of streams with changeable beds is a difficult problem. In case there is a weir or dam available, a condition which seldom exists on streams of this class, the discharge can be determined by its use. In case of velocity-area stations frequent discharge measurements must be made if the determinations of flow are to be other than rough approximations. For stations with beds which shift slowly, or are materially changed only during floods, rating tables can be prepared for periods between such changes and satisfactory results obtained with a limited number of measurements, provided that some of them are taken soon after the change occurs. For streams with continually shifting beds, such as the Colorado and Rio Grande, discharge measurements should be made every two or three days and the discharge for intervening days obtained either by interpolation modified by gage height or by Professor Stout's method, which has been described in full in the Nineteenth Annual Report of the United States Geological Survey, Part IV, p. 323, and in the Engineering News of April 21, 1904. This method, or a graphical application of it, is also much used in determining the flow at stations where the bed shifts but slowly.

COOPERATION AND ACKNOWLEDGMENTS.

Assistance has been rendered on records furnished by the following, to whom special acknowledgment is due:

Officers and employees of the United States Weather Bureau; The Pea River Power Company; J. M. Youngblood; Southern Railway; Georgia Railroad; Louisville and Nashville Railroad; Macon, Dublin and Savannah Railroad; Illinois Central Railroad; Atlanta and West Point Railroad; Seaboard Air Line Railway.

SOUTHERN ATLANTIC STATES DRAINAGES.

SANTEE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Santee River, which is formed in the central part of South Carolina by the junction of Congaree and Wateree rivers, flows southeastward and enters the Atlantic Ocean about 10 miles north of Cape Roumain. It has a total length of about 180 miles (following the course of the river) and drains an area of about 15,000 square miles. It is a navigable stream for its entire length and of course offers no opportunities for the development of power.

Wateree River, the more northerly of the two parent streams, rises on the eastern slope of the Blue Ridge, in McDowell County, N. C., and flows northeastward and then eastward, then bends abruptly to the southeast and flows in this general direction across the south central part of North Carolina and the north central part of South Carolina to its junction with the Congaree, practically paralleling Yadkin and Pedee rivers. Throughout its course in North Carolina, and also through that part of its course in South Carolina above the mouth of Wateree Creek it is known as Catawba River. The total length of the stream is about 270 miles in a straight line and about 450 miles when all the windings are followed.

The Wateree is navigable as far as Camden, but above that point the fall is so great that navigation is impracticable. In 1826 and following years the State of South Carolina spent large sums in the attempt to render the river navigable by means of locks and dams. Some large and important works were constructed at great expense, but the undertaking was abandoned before their completion. Linville and John rivers are the principal tributaries in North Carolina.

Wateree River crosses the fall line about 5 miles above Camden, S. C., in rapids about 5 miles in length, with a total fall of about 52 feet. The great falls of the Catawba are some distance above. This is the largest power in South Carolina and one of the largest in the Southern States, the available fall being 173 feet.

The average rainfall in the basin is about 50 inches, the annual total increasing as the stream is ascended. The greatest recorded flood on the river was in May, 1901, the gage reading at the Rockhill station being 24.15 feet and the measured discharge nearly 151,000 second-feet, or nearly 50 second-feet per square mile from the drainage basin above the station. The greatest flood previously experienced on the stream was in 1865. This was only 2 feet lower than the flood of May, 1901, on the lower part of the river, but the latter rise exceeded all previous records on the upper part of the river by from 8 to 15 feet.

The minimum flow recorded for the Rockhill station is 1,300 second-

feet, or about 0.43 second-foot per square mile. This occurred in September, 1895 and 1896. The maximum flow is about 116 times the minimum. During 1904 the minimum flow was 810 second-feet at the Catawba station. This was due to the storing of water at the new dam near Rockhill.

The Congaree, the second and more southerly of the two streams which by their union form the Santee, is formed by the junction of Broad and Saluda rivers between Lexington and Richland counties, S. C., whence it flows in a general southeasterly direction, but in a very tortuous channel, for about 60 miles to its junction with the Wateree. The stream is navigable to Columbia, the capital of the State. There it crosses the fall line, giving rise to a very fine water power, the only one on the stream, which is being extensively used in the manufacturing enterprises of Columbia.

Broad River rises on the eastern slope of the Blue Ridge near Hickory Nut Gap, in the southwestern part of McDowell County and the northeastern part of Henderson County, N. C., and flows in a general southeasterly direction across a portion of south-central North Carolina and north-central South Carolina to its junction with the Saluda at Columbia. The length of the river in a straight line is about 128 miles, but is much greater if the course of the river is followed.

The rainfall of the basin averages about 51 inches, of which about 13 inches fall in spring, the same in summer, about 10 in autumn, and about 15 in winter. It is probable that the precipitation in the region about the headwaters is much greater than these amounts indicate.

The maximum flood recorded at the Alston station on this stream, 25 miles above Columbia, occurred in May, 1901, the estimated discharge being 131,000 second-feet, equivalent to about 28 second-feet per square mile. The minimum flow recorded at the same place is 1,250 second-feet, equivalent to 0.27 second-foot per square mile. This occurred during October, 1904. The maximum flow is therefore about 105 times the minimum.

Saluda River is formed in western South Carolina by the junction of North, South, and Middle forks and flows southeastward to its junction with Broad River, the length of the stream being about 110 miles in a straight line. The three forks are mountain streams, and the character of the drainage basin is similar to that of Broad River.

The average rainfall over the basin of the stream is 51 inches, the amount and seasonal distribution being similar to that on the Broad. The maximum flood recorded at the Waterloo station on this stream occurred in February, 1902, the rise being 23 feet above low water and the estimated discharge being about 18,500 second-feet, equivalent to about 18 second-feet per square mile. The minimum discharge so far recorded is 200 second-feet, or about 0.19 second-foot per square mile. This occurred during October, 1904. The maximum discharge is therefore about 108 times the minimum.

CATAWBA RIVER NEAR MORGANTON, N. C.

The original station was established, in connection with the hydrographic investigation of the southern Apalachian area, on June 19, 1900, at which time a wire gage was installed on the highway bridge on the road from Morganton to Hartland. In May, 1901, the river throughout this part of its course rose from 8 to 15 feet higher than ever before known and the bridge and gage were destroyed. The present station was established May 15, 1903, at the bridge which was built to replace the one carried away by the flood of May, 1901. The station is 1 mile north of Morganton and about 200 yards below the mouth of Upper Creek. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 21, where are given also references to publications that contain data for previous years.

Discharge measurements of Catawba River near Morganton, N. C., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 2	Murphy and Hall	160	709	1.84	1,240
June 18	W. E. Hall	216	1,220	4.36	4,640

Daily gage height, in feet, of Catawba River near Morganton, N. C., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	1.65	3.3	1.9	3.1	2.15	1.5	17	2.35	2.05	2.6	2.8	1.7	4.0
2	1.65	2.8	1.85	2.8	2.05	1.45	18	2.15	2.0	2.1	2.6	1.6	3.35
3	3.4	2.7	1.85	2.4	2.05	1.4	19	2.15	2.0	2.85	2.5	1.6	2.85
4	5.6	2.6	2.05	2.25	2.0	2.75	20	2.0	1.95	2.8	2.35	1.55	3.3
5	2.8	2.6	2.35	2.15	2.3	2.2	21	1.9	2.1	2.5	2.2	1.55	2.7
6	2.45	2.5	2.25	2.2	2.05	1.95	22	2.3	2.0	2.35	2.15	1.5	3.45
7	2.3	2.3	2.1	2.2	2.05	1.7	23	13.1	2.2	2.35	2.1	1.6	3.0
8	2.2	2.25	2.3	2.1	2.0	1.65	24	5.4	2.2	2.2	2.1	1.55	2.1
9	2.0	2.2	2.2	2.0	1.9	1.6	25	4.0	2.1	2.05	1.95	1.45	2.05
10	1.85	2.1	2.1	1.95	1.9	2.4	26	3.8	2.1	2.0	1.9	1.6	2.05
11	2.9	2.05	1.95	1.9	1.85	2.1	27	4.0	2.05	1.9	1.8	2.05	1.9
12	3.3	2.2	1.9	1.9	1.7	2.5	28	3.9	1.95	1.9	1.8	1.7	1.85
13	2.6	2.2	1.8	1.8	1.9	3.15	29	3.8	.....	1.8	1.85	1.65	1.85
14	2.05	2.15	1.95	2.6	1.95	6.4	30	3.65	.....	4.3	1.9	1.65	1.8
15	3.15	2.15	4.2	2.0	1.8	9.8	31	3.5	.....	3.3	.....	1.55	.....
16	2.8	2.15	3.15	2.9	1.75	5.2							

NOTE.—Gage reading not taken during last six months.

Rating table for Catawba River near Morganton, N. C., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	740	2.60	2,160	3.80	3,800	6.00	7,700
1.50	840	2.70	2,290	3.90	3,950	7.00	9,800
1.60	950	2.80	2,420	4.00	4,100	8.00	12,000
1.70	1,060	2.90	2,550	4.20	4,400	9.00	14,300
1.80	1,180	3.00	2,680	4.40	4,710	10.00	16,600
1.90	1,300	3.10	2,810	4.60	5,040	11.00	19,000
2.00	1,420	3.20	2,940	4.80	5,390	12.00	21,400
2.10	1,540	3.30	3,080	5.00	5,750	13.00	23,900
2.20	1,660	3.40	3,220	5.20	6,110	14.00	26,400
2.30	1,780	3.50	3,360	5.40	6,490		
2.40	1,900	3.60	3,500	5.60	6,880		
2.50	2,030	3.70	3,650	5.80	7,280		

NOTE.—The above table is based on discharge measurements made during 1903–1906 and is well defined below gage height 2 feet.

Monthly discharge of Catawba River near Morganton, N. C., for 1906.

[Drainage area, 758 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	24,200	1,000	3,360	4.43	5.11
February	3,080	1,360	1,730	2.28	2.37
March	4,550	1,180	1,870	2.47	2.85
April	2,810	1,180	1,680	2.22	2.48
May	1,780	790	1,180	1.56	1.80
June	16,100	740	2,680	3.54	3.95

NOTE.—Values are rated as follows: January to April and June, good; May, excellent.

CATAWBA RIVER SURVEY.

In order to point out the power possibilities along Catawba River, a profile has been prepared showing the fall between Halltown Road Ford, N. C., and Camden, S. C. In connection with this survey notes showing tributary streams and other natural and artificial features along the river are indicated.

Sheets showing this profile may be obtained on application to the Director of the Geological Survey.

WATEREE RIVER NEAR CAMDEN, S. C.

Camden, S. C., is on Wateree River, 45 miles above its mouth and about 5 miles below the fall line. A station has been maintained by the United States Weather Bureau since 1891 at the toll bridge about 2 miles west of Camden. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 25, where are given also references to publications that contain data for previous years.

Discharge measurements of Wateree River near Camden, S. C., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 28	W. E. Hall	303	4,690	12.54	10,000
October 17	do	288	3,360	8.52	5,100

Daily gage height, in feet, of Wateree River near Camden, S. C., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	10.0	15.2	8.0	19.2	8.2	6.4	7.0	13.6	28.0	15.0	8.8	8.0
2	10.2	13.6	7.9	17.9	8.1	6.0	10.0	17.8	23.0	13.8	8.5	7.4
3	9.4	12.4	7.9	14.0	8.2	5.8	14.6	22.6	17.8	12.2	8.6	6.8
4	25.1	11.3	8.1	11.9	8.7	6.5	11.0	22.5	14.8	14.2	8.2	8.2
5	28.4	10.4	8.2	10.6	8.0	8.3	10.6	19.8	13.6	22.4	7.7	7.4
6	25.2	10.6	10.5	10.2	9.8	7.1	9.6	14.6	11.3	21.1	8.7	7.4
7	18.4	10.2	9.8	9.6	8.7	6.8	8.0	11.8	10.4	16.8	8.2	7.7
8	13.2	10.2	10.1	8.7	10.0	8.0	11.0	9.8	10.2	14.1	8.0	7.4
9	11.2	12.2	13.6	8.3	8.9	7.4	8.5	8.8	9.0	13.0	8.0	7.3
10	9.8	11.8	12.0	9.0	8.4	7.6	9.0	8.6	8.6	11.2	7.8	6.4
11	9.2	9.8	9.5	8.8	7.4	8.0	9.8	7.9	9.2	10.2	7.5	8.6
12	8.8	9.2	8.3	8.6	6.8	10.2	8.8	7.6	8.5	9.8	7.3	11.8
13	14.8	10.0	8.8	8.4	6.6	11.0	7.4	7.2	10.6	9.2	7.8	10.5
14	16.4	9.4	8.3	8.0	5.9	14.2	6.7	11.2	9.0	8.6	7.6	9.0
15	13.6	9.1	9.6	8.6	7.0	21.0	6.4	16.2	11.0	8.0	7.8	8.1
16	13.3	8.9	19.4	9.3	6.2	24.6	5.3	12.0	10.0	9.0	7.6	7.4
17	12.8	8.6	19.2	14.7	6.1	25.0	10.0	11.6	8.5	8.4	7.8	7.3
18	11.3	8.4	15.1	12.2	6.0	24.0	13.2	14.6	11.0	8.3	7.7	8.1
19	10.0	7.9	12.0	10.2	6.2	18.2	13.0	21.0	13.8	21.1	7.3	8.0
20	9.4	8.6	22.5	9.4	5.65	14.4	17.7	18.6	13.1	27.5	9.0	10.3
21	8.7	8.6	24.9	8.8	4.8	11.6	15.5	13.8	20.5	28.2	21.4	11.6
22	8.6	8.8	20.6	8.0	7.0	9.6	12.4	11.6	17.4	23.6	16.4	10.2
23	19.8	11.0	14.0	7.5	5.35	8.5	14.2	16.7	13.4	18.3	12.2	8.8
24	27.2	9.3	11.2	8.2	5.5	8.0	16.2	15.7	13.5	15.2	10.3	7.9
25	28.0	8.8	9.9	7.4	5.7	7.9	14.4	12.2	13.1	12.4	9.2	7.6
26	25.4	8.0	9.8	7.4	6.0	11.3	15.2	11.8	11.0	11.0	8.3	7.1
27	27.0	8.7	10.0	7.2	6.0	12.8	14.0	12.6	10.0	10.6	8.6	7.2
28	26.1	8.2	12.4	7.4	6.5	11.1	16.6	12.6	9.8	9.8	8.4	7.2
29	26.4	.....	12.8	7.4	8.4	8.6	13.6	20.0	10.7	9.0	8.0	7.6
30	22.1	.....	14.2	6.8	7.6	7.8	13.6	24.3	12.5	9.4	7.7	7.8
31	19.6	.....	17.7	.....	6.7	.....	13.8	27.5	.....	9.0	.....	7.4

Rating table for Wateree River near Camden, S. C., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.80	2,620	6.50	4,150	8.40	5,955	15.00	12,420
4.90	2,710	6.60	4,245	8.60	6,145	16.00	13,520
5.00	2,800	6.70	4,340	8.80	6,335	17.00	14,620
5.10	2,890	6.80	4,435	9.00	6,525	18.00	15,720
5.20	2,980	6.90	4,530	9.20	6,715	19.00	16,820
5.30	3,070	7.00	4,625	9.40	6,905	20.00	17,920
5.40	3,160	7.10	4,720	9.60	7,095	21.00	19,120
5.50	3,250	7.20	4,815	9.80	7,285	22.00	20,320
5.60	3,340	7.30	4,910	10.00	7,475	23.00	21,520
5.70	3,430	7.40	5,005	10.20	7,665	24.00	22,720
5.80	3,520	7.50	5,100	10.40	7,855	25.00	23,920
5.90	3,610	7.60	5,195	10.60	8,045	26.00	25,220
6.00	3,700	7.70	5,290	10.80	8,235	27.00	26,520
6.10	3,790	7.80	5,385	11.00	8,425	28.00	27,820
6.20	3,880	7.90	5,480	12.00	9,420		
6.30	3,970	8.00	5,575	13.00	10,420		
6.40	4,060	8.20	5,765	14.00	11,420		

NOTE.—The above table is based on discharge measurements made during 1904-1906 and is well defined below gage height 13 feet.

Monthly discharge of Wateree River near Camden, S. C., for 1906.

[Drainage area, 2,640 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	28,300	6,140	14,800	5.61	6.47
February	12,600	5,480	7,460	2.83	2.95
March	23,800	5,480	9,880	3.74	4.31
April	17,000	4,440	7,330	2.78	3.10
May	7,480	2,620	4,740	1.80	2.08
June	23,900	3,520	8,950	3.39	3.78
July	15,400	3,070	9,020	3.42	3.94
August	27,200	4,820	12,400	4.70	5.42
September	27,800	6,050	10,400	3.94	4.40
October	28,100	5,580	11,600	4.39	5.06
November	19,600	4,910	6,600	2.50	2.79
December	9,220	4,440	5,750	2.18	2.51
The year	28,300	2,620	9,080	3.44	46.81

NOTE.—Values for 1906 are rated as follows: January to October, good; November and December fair.

BROAD RIVER (OF THE CAROLINAS) AT ALSTON, S. C.

This station was established July 3, 1896, at the Southern Railway bridge at Alston, S. C., about 27 miles above Columbia. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 28, where are given also references to publications that contain data for previous years.

Discharge measurements of Broad River (of the Carolinas) at Alston, S. C., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 29	W. E. Hall	521	3,200	5.50	7,980
June 23	do	517	2,680	4.52	5,840
October 18	do	507	2,310	3.79	4,580

Daily gage height, in feet, of Broad River (of the Carolinas) at Alston, S. C., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.1	7.8	3.7	8.3	4.5	3.85	3.7	9.4	11.6	5.9	4.25	3.8
2	4.6	6.8	3.95	6.6	4.4	3.8	4.05	13.5	8.5	4.9	4.35	3.8
3	6.6	6.2	3.9	6.1	4.4	5.5	3.85	17.5	6.3	6.2	4.1	3.85
4	17.8	5.8	4.15	5.4	4.45	5.5	3.85	11.2	6.0	10.1	4.1	3.35
5	18.9	5.3	4.6	4.8	4.2	4.75	5.0	6.8	6.2	10.4	4.05	4.0
6	12.9	5.4	4.5	4.55	4.6	4.4	4.35	5.6	8.4	8.0	3.9	3.8
7	8.6	5.3	4.2	4.75	4.5	4.5	4.05	4.7	8.2	6.7	3.95	3.8
8	6.0	5.2	5.4	4.6	5.2	3.8	4.4	4.2	5.8	6.4	4.1	3.7
9	5.6	5.2	6.5	4.6	4.7	3.7	6.0	4.3	5.0	5.3	4.0	3.75
10	5.0	4.9	5.6	4.8	4.25	3.9	7.0	4.1	4.75	5.0	4.05	3.9
11	4.85	4.6	5.0	4.65	4.15	5.7	4.85	4.05	4.6	4.85	3.95	3.85
12	8.5	4.6	4.7	4.4	4.0	6.2	5.3	4.45	5.4	4.85	4.05	5.7
13	11.3	4.4	4.4	4.2	3.6	7.0	4.5	4.7	6.2	4.8	4.1	4.75
14	9.0	4.6	4.4	4.35	3.7	10.2	3.0	7.8	5.0	4.55	4.0	4.7
15	7.4	4.6	6.5	5.2	3.65	10.8	3.75	7.7	4.55	4.55	4.2	4.0
16	6.6	4.4	11.1	7.2	3.8	9.3	3.8	7.8	4.35	4.55	4.3	4.3
17	6.0	4.3	9.2	5.6	3.7	8.2	4.15	7.2	4.05	4.5	4.3	4.15
18	5.4	4.2	7.0	5.0	3.7	7.8	6.8	6.7	4.1	4.95	4.3	4.3
19	5.9	4.1	7.7	4.55	3.35	6.3	7.6	6.2	7.0	4.55	4.4	4.1
20	4.9	4.2	15.7	4.4	3.2	5.7	8.5	6.1	9.9	6.9	5.8	5.5

Daily gage height, in feet, of Broad River (of the Carolinas) at Alston, S. C., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	4.75	4.3	13.5	4.25	3.3	4.65	6.1	5.2	8.3	6.4	5.6	6.1
22	4.9	5.8	9.8	4.2	3.05	4.65	5.3	5.9	7.3	5.2	4.45	5.6
23	10.6	5.2	6.8	4.25	3.9	4.3	5.7	7.6	6.0	5.1	4.2	4.6
24	13.0	4.7	5.9	4.9	3.75	4.15	5.7	5.9	6.2	4.9	4.3	4.45
25	9.0	4.45	5.6	4.0	2.78	4.25	5.9	4.85	6.2	4.4	4.25	4.4
26	9.2	4.3	5.4	3.9	3.3	6.4	8.5	5.6	5.6	4.3	4.25	4.35
27	11.8	4.25	5.2	3.95	5.6	6.0	7.4	5.6	6.6	4.15	4.2	4.4
28	12.0	3.85	5.7	4.2	6.4	5.1	5.4	5.1	6.2	4.4	4.25	3.8
29	11.7	.....	5.7	4.05	5.6	4.45	4.9	9.8	5.9	4.4	3.2	4.4
30	10.0	.....	8.5	4.1	4.3	4.15	5.3	13.1	6.4	3.6	3.9	4.45
31	8.3	.....	10.3	.....	3.9	.....	5.9	15.2	.....	4.2	.....	5.2

Rating table for Broad River (of the Carolinas) at Alston, S. C., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.70	1,800	4.20	4,750	5.70	8,775	8.40	16,950
2.80	1,940	4.30	5,000	5.80	9,050	8.60	17,600
2.90	2,090	4.40	5,250	5.90	9,325	8.80	18,250
3.00	2,250	4.50	5,500	6.00	9,600	9.00	18,900
3.10	2,420	4.60	5,750	6.20	10,200	10.00	22,150
3.20	2,590	4.70	6,025	6.40	10,800	11.00	25,500
3.30	2,770	4.80	6,300	6.60	11,400	12.00	29,000
3.40	2,960	4.90	6,575	6.80	12,000	13.00	32,800
3.50	3,150	5.00	6,850	7.00	12,600	14.00	36,800
3.60	3,350	5.10	7,125	7.20	13,200	15.00	41,400
3.70	3,560	5.20	7,400	7.40	13,800	16.00	46,500
3.80	3,780	5.30	7,675	7.60	14,400	17.00	52,400
3.90	4,010	5.40	7,950	7.80	15,000	18.00	58,800
4.00	4,250	5.50	8,225	8.00	15,650	19.00	65,300
4.10	4,500	5.60	8,500	8.20	16,300		

NOTE.—The above table is based on discharge measurements made during 1901-1906, and is well defined between gage heights 3 feet and 10 feet.

Monthly discharge of Broad River (of the Carolinas) at Alston, S. C., for 1906.

[Drainage area, 4,610 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches
January	64,600	5,750	18,800	4.08	4.70
February	15,000	3,900	6,790	1.47	1.53
March	45,000	3,560	12,000	2.60	3.00
April	16,600	4,010	6,560	1.42	1.58
May	10,800	1,910	4,700	1.02	1.18
June	24,800	3,560	8,860	1.92	2.14
July	17,300	2,250	7,880	1.71	1.97
August	55,600	4,380	14,600	3.17	3.66
September	27,600	4,380	10,900	2.36	2.63
October	23,500	3,350	8,270	1.79	2.06
November	9,050	2,590	4,850	1.05	1.17
December	9,900	2,860	5,190	1.13	1.30
The year	6,460	1,910	9,120	1.98	26.92

NOTE.—Values are rated as follows: January to March and June to September, excellent; April, May, and October to December, good.

BROAD RIVER SURVEY.

In order to show the power possibilities along Broad River a profile has been compiled from data collected by the army engineers showing the fall of the river between Columbia, S. C., and Green River, N. C.

Sheets showing this profile may be obtained upon application to the Director of the Geological Survey.

MISCELLANEOUS MEASUREMENTS IN SANTEE RIVER DRAINAGE BASIN.

The following is a list of miscellaneous discharge measurements made in Santee River drainage basin during 1906:

John River near Morganton, N. C.—Measurements were made at the highway bridge on the Lenoir road, about 3 miles from Morganton, N. C. The bench mark is the upper edge of the end of a bar extending from the floor beam to a brace at the downstream end of the second floor beam from the left pier, 32 feet from the left end of the main span; elevation, 30 feet above the datum of the assumed gage.

March 2: Width, 63 feet; area, 182 square feet; gage height, 1.80 feet; discharge, 362 second-feet.

June 18: Width, 70 feet; area, 310 square feet; gage height, 3.67 feet; discharge, 1,530 second-feet.

Green River near Flat Rock, N. C.—Measurements were made at a single 50-foot span wagon bridge, 3½ miles northeast of Flat Rock, N. C. and about the same distance downstream from the crossing of the Southern Railway. The bench mark is the top of the drowstream end of the first floor beam from the left end of the bridge; elevation, 16 feet above the datum of the assumed gage.

June 13: Width, 45 feet; area, 184 square feet; gage height, 3.30 feet; discharge, 657 second-feet.

September 14: Width, 45 feet; area, 125 square feet; gage height, 1.14 feet; discharge, 158 second-feet.

SAVANNAH RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Savannah River is formed by the junction of Tugaloo and Seneca rivers, which unite about 100 miles above Augusta, Ga. It flows in a southeasterly direction, forming the boundary between Georgia and South Carolina, and empties into the Atlantic Ocean near Savannah, Ga. It is navigable to Augusta, which is at the fall line.

Seneca River is formed by the junction of Little and Keowee river, about 5 miles northeast of Seneca, S. C. Both of these tributaries rise in the Blue Ridge in North Carolina and the northwestern part of South Carolina.

Tugaloo River is formed by the junction of Chattooga and Tallulah rivers, which join at the west corner of Oconee County, S. C. It flows in a southeasterly direction, and is a part of the boundary between Georgia and South Carolina. Chattooga River rises in Jackson County, N. C., and flows in a southwesterly direction along the boundary between Georgia and South Carolina. Tallulah River rises in Macon County, N. C., and the northwestern part of Rabun County, Ga., and flows in a southeasterly direction. Parts of its course are cut

through solid rock for hundreds of feet, forming canyons and steep bluffs. Throughout its entire length the fall is very great, and at Tallulah Falls the stream drops more than 500 feet in a short distance.

Broad River joins the Savannah at the southeast corner of Elbert County, Ga. It rises in Habersham and Bank counties and flows in a southeasterly direction to the southeast corner of Madison County, Ga., where South Fork joins it. Thence it flows east to Savannah River. Its drainage is from a rolling country, and there is a considerable amount of fall at various points. At Anthony Shoals the fall is more than 50 feet in a short distance. Above Augusta, Ga., there is much fall, which can be developed for water power. With exception of the large plant at Augusta, very little of this is being used.

TALLULAH RIVER AT TALLULAH FALLS, GA.

This station was originally established August 29, 1900, and records of gage heights were obtained until October 19, 1900. The record was resumed January 18, 1901, and maintained until December 31, 1901. The station was reestablished July 10, 1904, when bench marks were determined and regular gage readings begun. The station is located at the wagon bridge about one-fourth mile above the falls and about the same distance from the village of Tallulah Falls, Ga. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 35, and in Water-Supply Paper No. 197, where are given also the data for previous years.

Discharge measurements of Tallulah River at Tallulah Falls, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 24	W. E. Hall	65	554	3.26	1,490
February 14	M. R. Hall	59	426	1.82	577
June 27	W. E. Hall	60	408	1.50	416
July 26	do	60	434	2.20	788
September 28	do	65	556	3.81	2,060
September 29	do	80	691	5.59	4,450
September 29	do	80	691	5.56	4,340
December 31	F. A. Murray	71	595	4.22	2,600
December 31	do	71	588	4.12	2,440

Daily gage height, in feet, of Tallulah River at Tallulah Falls, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.6	2.3	1.7	2.6	2.0	1.4	1.3	2.5	3.7	4.4	2.3	2.1
2	1.5	2.2	1.7	2.6	2.0	2.0	1.3	2.4	3.4	5.0	2.2	2.1
3	7.0	2.2	1.8	2.5	1.9	1.8	1.4	2.3	2.9	5.4	2.2	2.0
4	4.5	2.3	1.8	2.5	1.9	1.7	1.9	3.2	2.7	4.3	2.2	2.0
5	3.0	2.2	1.8	2.4	1.9	1.7	1.5	2.8	2.7	4.1	2.2	2.0
6	2.5	2.2	1.7	2.2	2.0	1.6	1.4	2.4	2.6	4.0	2.2	2.7
7	2.2	2.2	1.7	2.2	2.2	1.6	1.5	2.5	3.4	4.0	2.1	2.1
8	2.1	2.2	1.9	2.2	2.1	1.5	1.5	2.2	2.0	3.8	2.1	2.0
9	2.0	2.1	1.9	2.3	2.0	1.4	1.8	2.0	2.2	3.4	2.1	2.0
10	2.0	2.1	1.8	2.3	2.0	1.4	1.4	1.9	2.8	3.3	2.1	3.2

Daily gage height, in feet, of Tallulah River at Tallulah Falls, Ga., for 1906--Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	1.9	2.0	1.8	2.3	1.8	1.7	1.4	1.7	2.7	3.2	2.1	2.6
12	2.5	1.9	1.8	2.2	1.7	1.9	1.5	1.3	2.6	3.1	2.1	2.0
13	2.2	1.8	1.8	2.1	1.7	2.8	1.5	2.0	3.0	3.0	2.1	2.0
14	2.2	1.8	1.9	2.2	1.7	2.6	3.8	2.0	2.6	3.0	2.0	2.0
15	2.2	1.7	3.7	2.8	1.6	2.4	3.4	2.1	2.4	3.0	2.0	2.0
16	2.0	1.6	2.7	2.6	1.6	2.5	3.2	2.6	2.4	2.8	2.0	2.2
17	2.0	1.7	2.6	2.3	1.6	2.4	2.4	3.1	2.4	4.0	2.0	2.4
18	2.0	1.7	2.4	2.2	1.5	2.0	4.7	4.1	2.5	3.4	2.3	2.7
19	2.0	1.7	4.7	2.0	1.5	1.8	4.0	3.1	3.1	3.1	4.9	2.4
20	1.9	1.8	3.4	2.0	1.5	1.7	3.1	3.1	4.4	2.9	3.5	2.5
21	1.8	1.7	2.7	2.0	1.5	1.7	3.2	2.9	3.7	2.9	3.0	2.2
22	3.8	1.6	2.5	2.0	1.5	1.6	2.6	3.7	3.6	2.8	2.8	2.1
23	4.7	1.7	2.5	2.0	1.4	1.5	2.4	2.9	3.5	2.7	2.6	2.1
24	3.4	1.7	2.5	1.9	1.4	1.9	2.8	2.4	3.2	2.6	2.4	2.2
25	2.9	1.7	2.4	1.9	1.4	1.8	2.3	2.3	2.0	2.5	2.4	2.2
26	2.9	1.7	2.5	1.9	1.5	1.8	2.3	2.2	2.9	2.5	2.3	2.0
27	2.8	1.9	2.6	2.0	2.2	1.7	2.1	2.2	2.5	2.4	2.3	2.0
28	2.8	1.8	2.6	2.0	1.9	1.9	2.8	2.2	2.8	2.4	2.2	2.3
29	2.5	...	2.7	2.1	1.7	2.6	2.1	3.2	4.4	2.4	2.2	2.3
30	2.4	.....	3.4	2.1	1.6	1.4	2.5	8.0	5.4	2.4	2.1	3.0
31	2.3	.....	2.8	.....	1.5	.....	2.4	4.1	.....	2.4	.....	5.0

Rating table for Tallulah River at Tallulah Falls, Ga., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	355	2.30	860	3.30	1,600	4.60	3,000
1.40	395	2.40	930	3.40	1,690	4.80	3,260
1.50	435	2.50	1,000	3.50	1,780	5.00	3,530
1.60	480	2.60	1,070	3.60	1,880	5.20	3,810
1.70	525	2.70	1,140	3.70	1,980	5.40	4,110
1.80	575	2.80	1,210	3.80	2,080	5.60	4,410
1.90	630	2.90	1,280	3.90	2,180	5.80	4,730
2.00	685	3.00	1,360	4.00	2,290	6.00	5,060
2.10	740	3.10	1,440	4.20	2,510	7.00	6,930
2.20	800	3.20	1,520	4.40	2,750	8.00	9,000

NOTE.—The above table is based on discharge measurements made during 1904-1906 and is well defined below gage height 6 feet.

Monthly discharge of Tallulah River at Tallulah Falls, Ga., for 1906.

[Drainage area, 191 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	6,930	435	1,250	6.54	7.54
February	860	480	640	3.35	3.49
March	3,130	525	974	5.10	5.88
April	1,210	630	816	4.27	4.76
May	800	395	552	2.89	3.33
June	1,210	395	627	3.28	[illegible]
July	3,130	355	962	5.04	5.81
August	9,000	355	1,350	7.07	8.15
September	4,110	685	1,450	7.59	8.47
October	4,110	930	1,670	8.74	10.08
November	3,390	685	946	4.95	5.52
December	3,530	685	928	4.86	5.60
The year	9,000	355	1,010	5.31	72.29

NOTE.—Values for 1906 are excellent.

TUGALOO RIVER NEAR MADISON, S. C.

This station was originally established July 19, 1898, at Cooks Ferry, and was discontinued December 31, 1901, when the ferry was moved. It was reestablished July 7, 1903, at Holcombs Ferry, 1 mile west of Madison, S. C., and 900 feet below the Southern Railway bridge. This station is about 1½ miles above the point where the old station was located. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 38, where are given also references to publications that contain data for previous years.

Discharge measurements of Tugaloo River near Madison, S. C., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 16	M. R. Hall	156	557	3.45	1,330
June 26	W. E. Hall	160	634	3.68	1,410

Daily gage height, in feet, of Tugaloo River near Madison, S. C., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.45	5.2	3.6	6.6	4.45	3.25	3.2	7.3	8.0	14.4	5.2	4.6
2	3.35	5.0	3.5	6.0	4.15	3.5	3.0	6.0	6.8	11.2	5.1	4.55
3	13.4	4.85	4.25	5.6	4.05	3.65	3.1	5.2	6.3	15.4	5.0	4.5
4	18.0	4.75	6.6	5.4	4.35	4.5	4.9	6.0	6.0	14.0	4.95	4.45
5	9.0	4.65	5.6	5.2	4.05	3.7	3.7	5.8	6.4	11.1	4.9	4.35
6	6.2	4.55	4.55	5.2	3.95	3.7	3.3	5.4	5.8	11.2	4.85	4.3
7	5.4	4.55	4.25	5.0	4.35	3.35	3.75	5.4	9.4	10.6	5.2	4.8
8	5.0	4.4	4.85	4.85	4.05	3.25	3.6	5.0	7.3	9.6	4.7	4.3
9	5.2	4.35	4.65	4.8	3.9	3.15	4.6	4.7	5.7	8.8	4.65	4.3
10	4.75	4.25	4.35	5.6	3.75	3.3	3.6	4.5	5.5	8.4	4.6	4.2
11	4.35	4.15	4.15	4.85	3.75	4.2	3.3	4.4	5.2	8.0	4.6	7.1
12	5.2	4.25	4.05	4.7	3.7	3.4	3.8	4.2	8.0	7.7	4.55	5.1
13	4.85	4.3	3.95	4.6	3.65	5.8	3.35	4.2	9.2	7.4	4.5	4.7
14	4.85	4.15	3.95	4.55	3.6	6.9	3.2	4.8	5.6	9.2	4.4	4.6
15	4.65	4.05	12.2	7.2	3.55	5.2	17.5	7.2	5.3	7.0	4.6	4.45
16	4.85	3.95	7.2	5.8	3.45	6.2	9.3	7.2	5.1	6.9	4.5	4.3
17	4.55	3.85	5.6	5.2	3.4	5.4	8.3	5.4	4.95	6.7	4.5	5.9
18	4.35	3.8	5.0	4.95	3.35	4.7	12.9	12.7	9.2	6.6	9.7	7.4
19	4.35	3.75	11.2	4.75	3.25	4.15	7.9	7.1	16.2	8.7	11.5	5.4
20	4.15	3.75	9.0	4.65	3.3	4.0	7.4	7.6	14.0	7.1	8.4	5.6
21	4.05	3.85	6.8	4.55	3.2	3.75	7.6	6.1	9.5	6.7	6.9	5.3
22	10.2	4.35	6.0	4.45	3.3	3.55	6.5	6.1	8.8	6.4	6.3	5.2
23	18.0	3.95	5.6	4.4	3.25	3.4	5.9	6.6	8.1	6.3	5.8	4.8
24	9.0	3.85	5.2	4.25	3.15	3.7	6.8	6.6	7.7	6.1	5.5	4.6
25	7.2	3.8	5.0	4.25	3.1	3.6	5.4	5.8	7.4	6.0	5.2	4.4
26	6.8	3.7	4.95	4.15	3.45	3.75	5.1	5.6	7.3	5.8	5.1	4.35
27	6.8	3.7	4.95	4.15	5.5	3.4	4.8	6.1	6.9	5.7	5.0	4.3
28	6.6	3.65	5.2	4.45	3.9	3.3	5.4	5.2	7.3	5.6	5.5	4.5
29	6.2	.....	5.8	4.25	3.8	3.35	4.9	5.2	11.5	5.5	4.8	4.8
30	5.8	.....	8.9	4.85	3.5	3.2	5.9	16.8	19.6	5.4	4.7	4.6
31	5.6	.....	8.4	.....	3.35	.....	7.3	11.4	.....	5.3	.....	15.5

Rating table for Tugaloo River near Madison, S. C., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.00	1,075	3.80	1,575	4.60	2,170	5.80	3,180
3.10	1,130	3.90	1,640	4.70	2,250	6.00	3,365
3.20	1,190	4.00	1,710	4.80	2,330	6.20	3,555
3.30	1,250	4.10	1,780	4.90	2,410	6.40	3,745
3.40	1,315	4.20	1,855	5.00	2,490	6.60	3,940
3.50	1,380	4.30	1,930	5.20	2,660	6.80	4,140
3.60	1,445	4.40	2,010	5.40	2,830	7.00	4,340
3.70	1,510	4.50	2,090	5.60	3,000		

NOTE.—The above table is based on eleven discharge measurements made during 1905–6, and is well defined below gage height 4 feet. Above gage height 6.5 feet the rating curve is a tangent, the difference being 100 per tenth.

Monthly discharge of Tugaloo River near Madison, S. C., for 1906.

[Drainage area, 593 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	15,300	1,280	4,130	6.96	8.02
February	2,660	1,480	1,870	3.15	3.28
March	9,540	1,380	3,290	5.55	6.40
April	4,540	1,820	2,490	4.20	4.69
May	2,920	1,130	1,540	2.60	3.00
June	4,240	1,160	1,780	3.00	3.35
July	14,800	1,080	2,950	4.97	5.73
August	14,100	1,860	3,920	6.61	7.62
September	16,900	2,450	5,500	9.27	10.34
October	12,700	2,740	5,570	9.39	10.83
November	8,840	2,010	2,990	5.04	5.62
December	12,800	1,860	2,740	4.62	5.33
The year	16,900	1,080	3,230	5.45	74.21

NOTE.—The monthly values are rated as follows: January, March, and July to December, fair; February and April to June, good. The values for the low-water periods of the various months are excellent.

SAVANNAH RIVER AT WOODLAWN, S. C.

This station was established November 9, 1905. It is located at the Charleston and Western Carolina Railway bridge, 1,000 feet from the depot at Woodlawn, S. C., 17 miles above Augusta, Ga., and 10 miles above the Augusta water-power dam. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 40.

Discharge measurements of Savannah River at Woodlawn, S. C., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
November 9	M. R. Hall	409	2,120	3.49	3,220
November 21	F. A. Murray	417	2,200	3.31	3,060
1906.					
March 6	M. R. Hall	594	3,470	5.52	8,940
March 7	do	593	3,290	5.30	8,400
April 26	do	590	3,140	5.04	7,680
June 29	do	535	2,780	4.52	6,150
August 21	do	607	5,350	8.65	21,200
October 30	do	588	3,310	5.30	8,540

Daily gage height, in feet, of Savannah River at Woodlawn, S. C., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.0	6.8	5.0	8.1	5.25	4.6	4.4	9.7	9.2	10.8	5.3	5.1
2	5.6	6.4	4.9	7.0	5.2	4.2	6.2	8.4	7.2	9.4	5.2	5.0
3	5.8	6.2	4.95	6.6	5.05	4.5	5.6	8.1	6.4	10.6	5.2	5.0
4	16.5	6.1	5.1	6.2	5.2	5.65	6.4	7.4	6.0	13.4	5.2	5.05
5	18.6	5.9	6.5	6.0	5.5	6.7	7.6	7.4	6.3	12.1	5.2	4.9
6	12.6	5.7	5.6	5.95	5.4	5.6	5.8	6.8	7.0	9.8	5.15	4.9
7	8.0	5.8	5.3	5.8	6.3	5.05	5.0	6.1	6.3	9.3	5.1	5.1
8	6.8	6.0	5.8	5.7	7.0	4.7	5.2	5.7	6.0	8.2	5.1	5.2
9	6.3	6.8	8.8	5.7	6.2	4.5	9.4	5.4	5.5	7.3	5.05	5.0
10	6.2	6.4	7.6	6.2	5.3	4.55	8.8	5.35	5.35	7.0	5.0	5.0
11	5.8	6.0	6.4	6.2	5.0	4.9	6.6	5.35	5.2	6.8	5.0	6.2
12	8.1	6.0	5.8	5.8	4.9	5.1	5.75	5.3	6.8	6.4	5.0	7.9
13	8.4	5.95	5.35	5.5	4.8	9.7	5.5	5.5	9.2	6.3	5.05	6.3
14	7.1	6.1	6.4	5.5	4.85	11.3	5.1	6.6	7.7	6.2	5.05	5.7
15	6.4	5.8	11.4	6.4	4.65	10.0	5.15	6.4	6.0	6.1	5.1	5.4
16	6.1	5.65	14.6	7.2	4.65	12.0	11.2	6.3	5.55	6.0	5.3	5.2
17	6.1	5.45	12.2	6.3	4.6	12.4	10.0	6.2	5.2	6.0	5.3	5.2
18	6.0	5.3	8.3	5.75	4.5	9.9	10.1	6.1	7.5	6.0	5.3	5.35
19	5.7	5.3	8.2	5.7	4.5	7.7	11.3	6.9	10.1	6.8	6.3	7.0
20	5.6	5.2	16.7	5.4	4.5	6.2	9.6	7.8	12.6	7.5	8.4	7.2
21	5.7	5.5	15.6	5.4	4.45	5.5	8.4	8.8	12.1	6.4	6.9	7.2
22	5.5	6.2	10.3	5.3	4.4	5.2	7.3	7.6	8.8	6.0	6.1	6.5
23	14.0	6.1	7.6	5.2	4.4	4.95	7.6	6.4	7.3	5.85	5.75	5.9
24	19.2	5.5	6.8	4.85	4.5	4.75	6.8	6.0	7.6	5.8	5.6	5.6
25	13.2	5.3	6.5	5.1	4.5	4.8	7.6	5.8	7.7	5.65	5.4	5.4
26	11.6	5.2	6.2	5.0	4.4	4.7	7.7	5.2	7.7	5.6	5.3	5.3
27	12.4	5.1	6.1	5.0	7.0	4.7	6.2	6.8	7.4	5.55	5.3	5.3
28	11.4	5.0	7.1	5.45	7.5	4.7	5.9	7.4	6.7	5.45	5.25	5.25
29	9.4	.....	7.3	6.0	5.9	4.5	6.4	8.8	7.2	5.3	5.2	5.35
30	7.9	.....	7.6	5.6	5.1	4.5	7.1	8.3	8.6	5.3	5.15	5.65
31	7.1	.....	8.4	.....	4.8	.....	10.5	9.8	.....	5.3	.....	6.2

Rating table for Savannah River at Woodlawn, S. C., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.00	2,440	4.40	5,760	5.80	10,160	8.40	20,120
3.10	2,640	4.50	6,040	5.90	10,510	8.60	20,940
3.20	2,850	4.60	6,330	6.00	10,860	8.80	21,760
3.30	3,060	4.70	6,630	6.20	11,560	9.00	22,600
3.40	3,280	4.80	6,930	6.40	12,280	10.00	27,000
3.50	3,500	4.90	7,230	6.60	13,010	11.00	31,600
3.60	3,730	5.00	7,540	6.80	13,760	12.00	36,300
3.70	3,960	5.10	7,850	7.00	14,520	13.00	41,100
3.80	4,200	5.20	8,170	7.20	15,300	14.00	46,000
3.90	4,450	5.30	8,490	7.40	16,080	15.00	51,000
4.00	4,700	5.40	8,810	7.60	16,880	16.00	56,000
4.10	4,960	5.50	9,140	7.80	17,680	17.00	61,000
4.20	5,220	5.60	9,480	8.00	18,480	18.00	66,000
4.30	5,490	5.70	9,820	8.20	19,300	19.00	71,000

NOTE.—The above table is based on seven discharge measurements made during 1905–6, and is well defined below gage height 8 feet. Above gage height 14 feet the rating curve is a tangent, the difference being 500 per tenth.

Monthly discharge of Savannah River at Woodlawn, S. C., for 1905–6.

[Drainage area, 6,600 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
November 9–30	4,930	3,060	3,820	0.579	0.47
December	53,500	3,730	15,900	2.41	2.78
1906.					
January	72,000	9,140	23,400	3.55	4.09
February	13,800	7,540	10,300	1.56	1.62
March	59,500	7,230	18,900	2.86	3.30
April	18,900	7,080	10,500	1.59	1.77
May	16,500	5,760	8,210	1.24	1.43
June	38,200	5,220	12,600	1.91	2.13
July	33,000	5,760	16,100	2.44	2.81
August	26,100	8,170	14,400	2.18	2.51
September	39,200	8,170	16,500	2.50	2.79
October	43,100	8,490	16,000	2.42	2.79
November	20,100	7,540	9,030	1.37	1.53
December	18,100	7,230	9,780	1.48	1.71
The year	72,000	5,220	13,800	2.09	28.48

NOTE.—Values for 1905 and 1906 are excellent.

SAVANNAH RIVER AT AUGUSTA, GA.

Observations of river heights have been maintained since 1875 by the city of Augusta, Ga., at the city highway bridge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 41, and in Water-Supply Paper No. 197, where are given also data for previous years.

Discharge measurements of Savannah River at Augusta, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 8	M. R. Hall	561	4,140	9.42	8,640
April 27	do	550	3,880	8.89	7,200
August 20	do	576	6,590	13.92	20,000
October 29	do	557	3,840	9.44	8,400

Daily gage height, in feet, of Savannah River at Augusta, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	11.2	12.4	8.9	15.6	9.4	8.2	7.8	19.5	17.8	18.4	9.5	9.0
2	10.4	11.9	8.8	13.6	9.4	7.8	12.7	18.4	14.6	18.1	9.4	8.8
3	9.9	11.2	8.7	11.9	8.9	7.6	10.7	16.4	12.1	18.6	9.4	8.9
4	26.1	10.8	8.8	11.2	9.0	9.5	11.0	13.8	10.7	23.2	9.0	8.8
5	29.3	10.8	10.9	11.0	9.7	12.1	13.7	12.6	10.5	22.5	9.1	8.7
6	23.9	9.9	10.1	10.5	9.4	10.5	11.5	11.6	12.3	19.2	9.1	8.7
7	17.6	10.5	9.5	10.3	10.9	9.5	10.5	11.8	11.7	17.8	9.1	9.0
8	13.1	10.4	9.9	10.0	12.8	8.6	9.7	10.6	10.7	16.1	9.0	9.2
9	11.6	12.3	16.4	10.0	11.4	8.1	14.6	9.9	9.8	13.8	9.0	9.0
10	11.1	12.1	15.2	10.7	9.6	8.0	17.7	9.3	9.8	12.7	9.0	8.8
11	10.6	11.0	11.6	11.1	9.0	8.0	13.7	8.9	9.3	12.0	8.8	9.0
12	12.6	11.0	10.9	10.6	8.8	9.3	11.5	8.8	9.4	11.7	9.1	13.4
13	15.8	11.2	9.8	10.0	8.6	15.4	9.7	9.2	16.9	11.0	9.0	11.8
14	14.0	11.1	9.7	9.8	8.5	21.0	9.9	10.8	14.5	10.6	9.0	10.5
15	11.8	10.6	11.0	10.7	8.4	19.4	9.1	11.6	12.5	10.6	9.1	9.8

Daily gage height, in feet, of Savannah River at Augusta, Ga., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	11.0	10.2	24.3	12.0	8.2	23.7	17.8	11.2	10.6	10.6	9.2	9.2
17	10.8	9.6	22.8	11.5	8.0	24.3	19.5	11.4	9.4	10.5	9.3	9.2
18	10.8	9.5	18.8	10.5	8.0	20.4	18.0	10.6	11.6	10.5	9.2	9.5
19	10.1	9.4	13.4	9.8	8.0	16.0	20.9	11.0	17.9	11.2	10.0	11.1
20	9.9	9.3	26.9	9.6	7.8	12.6	17.9	13.8	21.9	13.5	14.5	12.5
21	9.7	9.2	27.2	9.5	7.8	10.5	16.5	15.2	22.4	11.7	12.7	13.5
22	10.0	10.8	21.5	9.4	7.8	9.4	14.0	14.5	17.5	11.0	11.0	12.1
23	20.0	10.9	15.6	9.5	7.7	9.1	13.9	12.7	14.1	10.5	10.2	10.5
24	28.8	10.1	13.1	8.9	7.8	8.5	12.9	12.3	13.4	10.0	9.9	10.0
25	25.1	9.4	11.8	8.8	8.2	8.6	13.3	10.9	15.9	9.9	9.5	9.5
26	22.6	9.3	11.4	8.8	8.0	9.0	14.2	10.5	14.2	9.9	9.5	9.5
27	24.2	9.2	11.1	8.8	10.5	8.6	12.4	11.3	14.0	9.6	9.3	9.3
28	22.3	9.0	13.2	9.1	13.3	8.7	10.6	12.2	12.7	9.5	9.2	9.3
29	18.8	.....	14.4	10.6	11.2	8.0	11.1	14.8	12.7	9.5	9.2	9.6
30	15.6	.....	13.7	10.2	9.2	7.9	11.9	14.8	15.0	9.4	9.1	10.0
31	13.6	.....	15.2	.....	8.6	.....	19.8	16.6	.....	9.4	.....	10.2

NOTE.—These gage heights are the mean of four readings per day.

Rating table for Savannah River at Augusta, Ga., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
7.60	5,100	9.30	8,040	11.00	11,800	16.00	25,900
7.70	5,250	9.40	8,250	11.20	12,260	17.00	29,400
7.80	5,400	9.50	8,460	11.40	12,740	18.00	33,200
7.90	5,560	9.60	8,670	11.60	13,220	19.00	37,300
8.00	5,720	9.70	8,890	11.80	13,700	20.00	41,700
8.10	5,880	9.80	9,110	12.00	14,200	21.00	46,400
8.20	6,040	9.90	9,330	12.20	14,700	22.00	51,500
8.30	6,210	10.00	9,550	12.40	15,220	23.00	57,000
8.40	6,380	10.10	9,770	12.60	15,740	24.00	62,960
8.50	6,550	10.20	9,990	12.80	16,260	25.00	69,000
8.60	6,720	10.30	10,210	13.00	16,800	26.00	75,500
8.70	6,900	10.40	10,430	13.20	17,340	27.00	82,300
8.80	7,080	10.50	10,650	13.40	17,900	28.00	89,500
8.90	7,260	10.60	10,880	13.60	18,460	29.00	97,000
9.00	7,450	10.70	11,110	13.80	19,020	30.00	105,000
9.10	7,640	10.80	11,340	14.00	19,600		
9.20	7,840	10.90	11,570	15.00	22,650		

NOTE.—The above table is based on discharge measurements made during 1904–1906 and earlier high-water measurements, and is well defined.

Monthly discharge of Savannah River at Augusta, Ga., for 1906.

[Drainage area, 7,300 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	99,400	8,890	30,900	4.23	4.88
February	15,200	7,450	10,600	1.45	1.51
March	83,700	6,900	23,300	3.19	3.68
April	24,600	7,080	10,800	1.48	1.65
May	17,600	5,250	8,020	1.10	1.27
June	64,700	5,100	16,100	2.21	2.47
July	45,900	5,400	19,500	2.67	3.08
August	39,500	7,080	16,200	2.22	2.56
September	53,700	8,040	19,600	2.68	2.99
October	58,200	8,250	18,700	2.56	2.95
November	21,100	7,080	8,820	1.21	1.35
December	18,200	6,900	9,580	1.31	1.51
The year	99,400	5,100	16,000	2.19	29.90

NOTE.—Values for 1906 are good; the records at Woodlawn are better than at Augusta.

BROAD RIVER (OF GEORGIA) NEAR CARLTON, GA.

This station was established May 27, 1897. It is located at the Seaboard Air Line bridge 3 miles east of Carlton, Ga., and 2 miles above the mouth of the South Fork, and is now maintained and the observer paid by the United States Weather Bureau. The gage was read during 1906 by M. C. Power. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 48, and in Water-Supply Paper No. 197, where are given also data for previous years.

Discharge measurements of Broad River (of Georgia) near Carlton, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 31	W. E. Hall	202	914	4.71	2,560
July 18	M. R. Hall	196	1,030	5.95	3,990
October 19	W. E. Hall	200	817	4.10	1,970

Daily gage height, in feet, of Broad River (of Georgia) near Carlton, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec
1	2.6	3.5	2.4	4.2	2.8	2.4	2.4	3.8	3.7	3.6	2.6	2.5
2	2.5	3.3	2.4	3.5	2.7	2.4	2.4	3.3	3.0	3.9	2.6	2.5
3	4.6	3.0	2.5	3.5	2.7	2.6	2.6	3.2	2.9	5.5	2.6	2.5
4	14.3	2.9	3.0	3.2	3.7	3.4	3.1	3.2	2.7	6.0	2.5	2.5
5	12.9	2.9	2.9	3.2	3.0	2.7	2.8	4.2	2.7	4.7	2.5	2.5
6	7.0	3.0	2.5	3.1	2.8	2.6	2.6	4.4	2.6	4.0	2.5	2.5
7	3.5	3.0	2.5	3.0	3.3	2.5	3.0	3.0	2.8	3.8	2.5	2.6
8	3.3	2.8	3.3	3.0	4.0	2.5	4.3	2.8	2.6	3.6	2.5	2.6
9	3.1	2.7	5.5	3.0	3.5	2.4	6.3	2.6	2.6	3.4	2.5	2.5
10	3.0	2.6	3.9	3.1	3.0	2.4	6.0	2.5	2.6	3.0	2.5	2.5
11	3.0	2.6	3.2	3.0	2.8	3.1	5.0	2.5	2.6	3.0	2.5	4.6
12	3.4	2.6	3.0	3.0	2.7	2.9	3.5	2.4	3.9	3.0	2.5	4.4
13	4.0	2.6	3.0	2.9	2.7	4.4	3.3	2.5	3.2	2.9	2.5	3.4
14	3.0	2.5	2.8	2.9	2.6	5.3	3.6	4.1	3.0	2.8	2.5	3.0
15	2.9	2.5	11.0	3.7	2.5	4.5	4.2	3.4	2.8	2.8	2.6	3.0
16	2.8	2.5	14.0	3.5	2.5	3.8	5.5	3.1	2.5	2.6	2.6	2.8
17	2.8	2.5	8.3	3.1	2.5	5.6	7.9	2.8	2.5	2.6	2.6	2.8
18	2.7	2.5	4.2	3.0	2.5	4.0	6.4	2.6	4.0	2.6	3.0	3.0
19	2.7	2.5	8.8	2.9	2.5	3.6	6.2	8.2	4.5	4.0	3.1	3.0
20	2.6	2.5	15.7	2.8	2.5	2.8	5.2	7.9	8.2	3.6	3.1	4.0
21	2.6	2.6	11.2	2.8	2.4	2.7	4.6	6.4	5.0	2.9	3.0	3.8
22	2.8	2.7	6.0	2.8	2.4	2.6	4.1	5.8	4.0	2.9	3.0	3.6
23	19.0	2.5	3.8	2.7	2.4	2.6	5.0	3.5	3.3	2.8	2.8	3.1
24	9.8	2.5	3.6	2.7	2.4	2.5	4.2	3.1	3.0	2.8	2.7	3.0
25	6.0	2.5	3.5	2.7	2.3	2.5	3.6	2.8	3.9	2.7	2.6	3.0
26	4.4	2.5	3.3	2.7	2.8	2.5	3.2	3.2	4.7	2.6	2.6	2.8
27	6.9	2.5	3.3	2.8	4.1	2.9	2.9	3.1	3.8	2.6	2.6	2.8
28	5.3	2.5	3.8	3.9	3.7	2.7	3.0	3.6	3.2	2.6	2.5	2.9
29	4.0	.....	4.0	3.0	3.2	2.6	3.8	4.6	3.6	2.6	2.5	3.0
30	3.8	.....	4.6	3.0	2.6	2.6	7.6	4.6	4.0	2.6	2.5	3.0
31	3.5	.....	4.8	.....	2.5	.....	4.6	4.0	.....	2.6	.....	3.6

Rating table for Broad River (of Georgia) near Carlton, Ga., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.30	645	3.60	1,535	4.90	2,770	9.00	8,220
2.40	695	3.70	1,620	5.00	2,880	10.00	9,760
2.50	750	3.80	1,705	5.20	3,100	11.00	11,360
2.60	805	3.90	1,790	5.40	3,325	12.00	13,000
2.70	865	4.00	1,880	5.60	3,560	13.00	14,700
2.80	930	4.10	1,970	5.80	3,800	14.00	16,400
2.90	1,000	4.20	2,065	6.00	4,050	15.00	18,100
3.00	1,070	4.30	2,160	6.20	4,300	16.00	19,800
3.10	1,140	4.40	2,255	6.40	4,560	17.00	21,500
3.20	1,215	4.50	2,350	6.60	4,820	18.00	23,200
3.30	1,290	4.60	2,450	6.80	5,090	19.00	24,900
3.40	1,370	4.70	2,555	7.00	5,360		
3.50	1,450	4.80	2,660	8.00	6,760		

NOTE.—The above table is based on discharge measurements made during 1904-1906 and is well defined below gage height 6 feet. Above gage height 6 feet it is based on one high-water measurement in 1899.

Monthly discharge of Broad River (of Georgia) near Carlton, Ga., for 1906.

[Drainage area, 762 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	24,900	750	3,620	4.75	5.48
February	1,450	750	871	1.14	1.19
March	19,300	695	3,630	4.76	5.49
April	2,060	865	1,150	1.51	1.68
May	1,970	645	989	1.30	1.50
June	3,560	695	1,200	1.57	1.75
July	6,620	695	2,340	3.07	3.54
August	7,050	695	1,870	2.45	2.82
September	7,050	750	1,530	2.01	2.24
October	4,050	805	1,330	1.75	2.02
November	1,140	750	834	1.09	1.22
December	2,450	750	1,120	1.47	1.70
The year	24,900	645	1,710	2.24	30.63

NOTE.—Values for 1906 are excellent.

MISCELLANEOUS MEASUREMENTS IN SAVANNAH RIVER DRAINAGE BASIN.

The following is a list of miscellaneous discharge measurements made in Savannah River drainage basin during 1906:

Chauga River near Madison, S. C.—On May 16, 1906, a measurement was made at a new wagon bridge replacing the one formerly used, which was washed away during 1905. The new bridge, which is 30 feet upstream from the old location, is 2 miles east of Madison, S. C., and about 1 mile above mouth of the river. One of the old bench marks was in place and used to preserve the data formerly used in establishing new bench marks. The bench mark is the lower side of a hole drilled horizontally in the vertical face of a solid rock on the left bank, 10 feet above the bridge; elevation, 4.76 feet above the datum of the assumed gage.

Width, 51 feet; area, 100 square feet; gage height, 3.48 feet; discharge, 213 second-feet.

Broad River (of Georgia) at Anthony Shoals, Georgia.—Measurements were made by W. J. Lester during September, 1905, to determine the low-water flow for purposes of power development. The gage is an upright post sunk in the river bed at a point one-half mile above the shoals. Measurements were made at different sections.

Discharge measurements of Broad River (of Georgia) at Anthony Shoals, Georgia, in 1905.

Date.	Width.	Area of section.	Gage height.	Discharge.
	Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
September 13	224	1,800	2.16	867
September 14	222	1,730	1.82	641
September 15	221	1,690	1.64	530
September 16	206	1,010	1.60	500
September 18	186	592	1.54	464
September 19	186	590	1.53	451
September 25	185	572	1.43	397

OGEECHEE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Ogeechee River is formed by the junction of Williamsons Swamp Creek and Rocky Comfort Creek in Jefferson County, Ga., and drains a small basin in southeastern Georgia lying between the Savannah and Altamaha basins. It flows in a southeasterly direction and empties into the Atlantic Ocean. Its main tributary is Cannoochee River, which rises in Emanuel County, Ga., flows southeastward, and joins it about 20 miles from the Atlantic Ocean. The streams in this basin flow through a country that is mostly low. The current is generally good, but the fall available for power is probably small. The bank on one side or the other of the stream is generally low and swampy.

CANNOOCHEE RIVER NEAR GROVELAND, GA.

This station was established June 12, 1903. It is located at Moody's bridge, 3 miles south of Groveland, Bryan County, Ga. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 51, and in Water-Supply Paper No. 197, where are given also data for previous years.

Discharge measurements of Cannoochee River near Groveland, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 7	F. A. Murray	132	1,270	11.21	2,650
May 25	do	91	345	3.06	244
August 31	W. E. Hall	108	717	6.65	1,080

Daily gage height, in feet, of Cannoochee River near Groveland, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.8	10.1	7.7	7.3	2.4	3.4	4.7	9.0	5.8	3.8	2.4	2.1
2	5.0	9.6	7.0	6.9	2.3	3.1	5.7	10.5	6.0	3.8	2.4	2.1
3	5.4	8.6	6.8	6.6	2.2	2.9	5.2	13.0	6.2	3.9	2.3	2.1
4	5.7	7.0	8.9	6.4	2.2	3.9	5.8	11.9	6.1	5.3	2.2	2.2
5	6.0	6.6	11.7	5.8	2.2	4.5	6.4	10.5	6.0	7.4	2.3	2.5
6	6.6	6.1	12.5	5.2	2.1	5.7	7.1	10.0	5.9	8.4	2.3	2.5
7	7.1	6.1	11.4	4.8	2.5	7.6	7.6	9.7	5.8	7.4	2.3	2.7
8	7.0	7.0	10.0	4.8	5.0	8.4	7.7	9.0	5.0	6.8	2.2	2.9
9	6.6	7.8	10.4	4.6	5.5	7.5	7.8	8.0	4.6	5.2	2.1	2.7
10	6.2	9.1	11.1	4.1	4.6	4.7	9.1	7.0	4.0	4.5	2.1	2.5
11	6.1	10.0	11.3	4.0	4.3	4.2	10.4	6.5	3.6	4.3	2.1	2.3
12	5.8	11.1	10.9	3.9	3.7	7.0	12.7	5.0	3.3	4.0	2.0	2.3
13	5.6	11.7	10.5	3.8	3.3	9.6	10.8	5.5	3.3	3.5	2.0	2.3
14	5.4	12.0	9.9	3.7	3.0	11.9	9.6	4.9	3.3	3.5	2.0	2.3
15	5.3	11.6	9.2	4.0	2.8	14.0	8.0	4.9	3.0	3.0	2.1	2.3
16	5.2	11.2	8.3	4.8	2.6	17.0	7.2	5.0	3.3	3.0	2.2	2.2
17	5.2	11.0	7.4	4.8	2.6	17.2	9.2	4.6	3.3	2.8	2.3	2.1
18	5.1	10.5	6.8	4.9	2.5	16.4	10.9	4.5	3.4	2.7	2.4	2.0
19	5.0	9.8	6.4	5.0	2.3	15.2	12.2	4.4	3.4	2.7	2.4	2.0
20	4.9	8.9	7.0	4.9	2.3	13.2	12.5	4.3	3.5	2.9	2.4	2.0
21	4.8	7.8	8.6	4.5	2.2	11.4	13.2	3.3	3.4	3.0	2.4	2.0
22	5.0	8.5	9.7	4.3	2.1	10.2	11.9	4.0	3.2	3.2	2.4	2.1
23	5.1	9.8	9.5	3.9	2.0	8.2	10.9	4.5	3.1	3.2	2.4	2.3
24	6.4	10.3	9.4	3.3	2.1	7.2	10.7	6.0	3.0	3.1	2.4	2.5
25	6.7	9.2	9.3	3.1	3.8	6.6	10.9	6.8	3.4	3.0	2.4	2.6
26	7.5	9.42	8.9	3.0	4.8	5.5	11.9	6.4	3.6	2.9	2.3	2.6
27	9.0	8.5	8.0	2.8	5.1	4.4	12.4	6.2	3.8	2.9	2.2	2.6
28	10.3	8.2	7.3	2.6	4.4	4.3	12.2	6.5	4.3	2.8	2.2	2.6
29	11.1	.....	7.0	2.5	4.2	4.1	10.5	5.8	4.3	2.7	2.1	2.6
30	10.5	.....	7.2	2.4	3.8	4.4	9.4	5.8	3.9	2.7	2.1	2.7
31	10.7	.....	7.4	.....	3.5	.....	8.3	5.8	.....	2.7	.....	2.9

Rating table for Cannoochee River near Groveland, Ga., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet*	*Sec.-ft.*
2.00	75	3.30	257	4.60	554	6.80	1,183
2.10	85	3.40	276	4.70	580	7.00	1,245
2.20	96	3.50	296	4.80	606	7.20	1,309
2.30	107	3.60	317	4.90	633	7.40	1,373
2.40	119	3.70	338	5.00	660	7.60	1,438
2.50	131	3.80	360	5.20	714	7.80	1,504
2.60	144	3.90	382	5.40	769	8.00	1,570
2.70	158	4.00	405	5.60	825	9.00	1,915
2.80	172	4.10	429	5.80	882	10.00	2,275
2.90	187	4.20	453	6.00	940	11.00	2,650
3.00	203	4.30	478	6.20	1,000	12.00	3,025
3.10	220	4.40	503	6.40	1,060		
3.20	238	4.50	528	6.60	1,121		

NOTE.—The above table is based on discharge measurements made during 1903–1906 and is well defined below gage height 6.2 feet. Above gage height 10 feet the rating curve is a tangent, the difference being 375 per foot.

Monthly discharge of Cannoochee River near Groveland, Ga., for 1906.

[Drainage area, 960 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	2,690	606	1,120	1.17	1.35
February	3,020	970	2,010	2.09	2.18
March	3,210	1,060	1,920	2.00	2.31
April	1,340	119	539	.561	.63
May	797	75	272	.283	.33
June	4,980	187	1,750	1.82	2.03
July	3,480	580	2,120	2.21	2.55
August	3,400	257	1,230	1.28	1.48
September	1,000	203	468	.488	.54
October	1,710	158	432	.450	.52
November	119	75	102	.106	.12
December	187	75	118	.123	.14
The year	4,980	75	1,010	1.05	14.18

NOTE.—Values are rated as follows: January to April and June to October, good; May, November, and December, fair.

ALTAMAHA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Altamaha River is formed by the junction of Oconee and Ocmulgee rivers, which unite at the southern boundary of Montgomery County, Ga. Ohoopee River is also a tributary and enters it from the north side, about 50 miles below the junction of the Oconee and Ocmulgee. The Altamaha River drainage basin is entirely within the State of Georgia. The river rises in the north-central part and flows in a southeasterly direction, emptying into the Atlantic Ocean near Darien. Below the junction of the Oconee and Ocmulgee and for a long distance above on both rivers there is no great amount of fall. Steamboat navigation is carried on from Darien to Macon on the Ocmulgee, and to Dublin, and at times to Milledgeville, on the Oconee.

Ohoopee River rises in Washington County and flows in a southeasterly direction to the Altamaha. It flows from low hills of southeastern Georgia into the flat pine lands. Though it has not so much fall as the more northern streams, it has considerable fall that can be developed into power.

Oconee River rises on the southern slope of the Chattahoochee Ridge, in Hall County, and joins the Middle Oconee on the southwest boundary of Clarke County. Thence it flows in a southeasterly direction to the Altamaha. Apalachee River is a large tributary which rises in Gwinnett and Walton counties and enters the Oconee near the southeast corner of Morgan County. Little River enters the main stream at the corner of Putnam, Hancock, and Baldwin counties, about 15 miles above Milledgeville, Ga. These tributaries have much

fall, and a small part of it is developed. The Oconee has a fall of 250 feet in 45 miles. It has some very large water powers available from its source down to Milledgeville, where it crosses the fall line.

Ocmulgee River, the westernmost of the main tributaries, rises in the north-central part of Georgia on the southern slope of the Chattahoochee Ridge, in Fulton, Dekalb, and Gwinnett counties. It is formed by the junction of Yellow and South rivers just south of the south corner of Newton County. Yellow River rises in Gwinnett County and flows in a southerly direction into the Ocmulgee. South River rises in Fulton and Dekalb counties and flows in a southeasterly direction. Alcovy River joins the Ocmulgee about 5 miles below the junction of South and Yellow rivers. Towaliga River enters the Ocmulgee at about the southwest corner of Jasper County.

All these tributaries rise in and flow through a very hilly country and have a great deal of fall. Ocmulgee River has a fall of over 210 feet in 35 miles. The last fall of much size is only a few miles above Macon, Ga.

OCMULGEE RIVER NEAR JACKSON, GA.

This station, located at Pittmans Ferry, 8 miles southeast from Jackson, Ga., was established on May 18, 1906, to take the place of the old Flovilla station 5 miles below, the conditions being much more favorable for a constant rating.

Measurements are made from a boat, but as the meter is suspended from the ferry cable the boat is merely for carrying the hydrographer. The vertical gage is at the right bank about 15 feet above the ferry landing. Section 0 to 7 feet is attached to a post, which is securely placed and braced to a tree, and section 7 feet to 15 feet is attached to the tree. The observer is C. A. Pittman.

The section is deep at the measuring point and may change considerably, owing to the filling of the bed, but the permanent rock shoal about 400 feet below will control the height of water at the gage.

The bench mark is the top of an iron-pipe post firmly planted 4 feet south of a cedar tree, which is 20 feet south of the road and 450 feet west of the gage; elevation, 27.99 feet above gage datum.

Discharge measurements of Ocmulgee River near Jackson, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 14	F. A. Murray	298	1,530	4.92	1,680
May 18	do	298	1,440	4.43	920
October 9	W. E. Hall	300	1,670	5.19	2,170
October 10	do	300	1,610	5.02	1,810

Daily gage height, in feet, of Ocmulgee River near Jackson, Ga., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		4.4	4.4	5.6	5.1	4.9	4.5	4.5
2		4.4	4.4	5.3	5.4	10.8	4.4	4.5
3		4.5	4.5	5.1	5.5	12.4	4.4	4.5
4		5.8	4.7	5.5	4.8	12.4	4.5	4.5
5		4.7	4.5	5.6	4.6	9.2	4.5	4.5
6		4.5	4.45	5.6	4.5	6.6	4.5	4.45
7		4.45	4.4	5.3	4.4	6.0	4.5	4.45
8		4.4	4.45	5.2	4.4	5.5	4.5	4.6
9		4.4	5.8	4.8	4.4	5.3	4.5	4.55
10		4.4	5.3	4.6	4.4	5.1	4.5	4.5
11		4.4	4.8	4.6	4.4	4.9	4.5	4.8
12		4.4	4.7	4.7	4.4	4.8	4.5	5.0
13		12.9	4.5	4.5	5.3	4.8	4.5	4.8
14		12.4	4.5	6.6	4.8	4.8	4.5	4.7
15		9.9	5.0	5.5	4.5	4.7	4.7	4.65
16		8.2	5.2	5.2	4.4	4.7	4.75	4.6
17		7.8	4.8	5.0	4.3	4.7	4.7	4.6
18	4.4	7.0	5.5	5.0	4.8	4.6	4.8	4.8
19	4.4	6.0	6.7	4.7	5.5	5.1	5.4	4.95
20	4.4	5.55	6.2	4.6	5.5	5.0	5.0	5.2
21	4.4	5.1	5.4	4.6	6.8	4.8	4.8	5.25
22	4.5	5.0	5.0	4.5	6.0	4.7	4.75	5.1
23	4.45	4.8	6.6	6.0	5.9	4.7	4.75	4.9
24	4.45	4.7	6.7	5.4	5.6	4.7	4.65	4.8
25	4.45	4.6	5.5	4.8	6.0	4.7	4.65	4.7
26	4.45	4.6	5.4	4.7	5.4	4.6	4.6	4.6
27	4.7	4.6	4.9	5.0	5.0	4.6	4.55	4.6
28	4.75	4.5	4.7	4.9	5.5	4.6	4.55	4.7
29	4.7	4.5	5.9	5.1	5.2	4.6	4.5	5.0
30	4.55	4.45	5.4	5.5	5.1	4.55	4.5	5.25
31	4.5	.....	5.9	5.3	.....	4.55	.....	6.0

Rating table for Ocmulgee River near Jackson, Ga., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.30	750	5.40	2,560	6.50	5,000	8.20	9,700
4.40	870	5.50	2,760	6.60	5,250	8.40	10,300
4.50	1,000	5.60	2,970	6.70	5,510	8.60	10,920
4.60	1,140	5.70	3,180	6.80	5,770	8.80	11,540
4.70	1,290	5.80	3,390	6.90	6,030	9.00	12,170
4.80	1,450	5.90	3,610	7.00	6,300	10.00	15,500
4.90	1,620	6.00	3,830	7.20	6,840	11.00	18,900
5.00	1,800	6.10	4,060	7.40	7,380	12.00	22,300
5.10	1,980	6.20	4,290	7.60	7,940	13.00	25,700
5.20	2,170	6.30	4,520	7.80	8,510		
5.30	2,360	6.40	4,760	8.00	9,100		

NOTE.—The above table is based on four discharge measurements made during 1906 and is well defined below gage height 5.2 feet. Above gage height 6 feet the curve becomes uncertain and is only approximate at the higher stages.

Monthly discharge of Ocmulgee River near Jackson, Ga., for 1906.

[Drainage area, 1,500 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
May (18-31)	1,370	870	1,020	0.680	0.36
June	25,400	870	4,070	2.71	3.02
July	5,510	870	2,240	1.49	1.72
August	5,250	1,000	2,080	1.39	1.60
September	5,770	750	2,030	1.35	1.51
October	23,700	1,070	4,010	2.67	3.08
November	2,560	870	1,180	.787	.88
December	3,830	935	1,450	.967	1.11

NOTE.—Values are rated as follows: May, July to September, November, and December, excellent; June and October, good.

OCMULGEE RIVER AT MACON, GA.

A station was established at Macon, Ga., January 21, 1893, by the United States Weather Bureau. Discharge measurements were begun by the United States Geological Survey in 1895, and a wire gage was established on the bridge of the Macon, Dublin and Savannah Railroad and was set on the same datum as the Weather Bureau gage. For a time gage-height records were maintained by the Geological Survey, as the Weather Bureau records were for a part of the year only and were discontinued altogether from June 30, 1897, to June 1, 1899. Since June 1, 1899, the Weather Bureau gage-height records have been taken continuously and have been furnished to the Geological Survey. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 58, and in Water-Supply Paper No. 197, where are given also data for previous years.

Discharge measurements of Ocmulgee River at Macon, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 5	F. A. Murray	255	2,130	4.54	2,500
May 24	do	231	1,440	2.40	1,300
August 29	W. E. Hall	228	3,160	9.14	5,040
October 11	do	257	1,890	4.91	2,530

Daily gage height, in feet, of Ocmulgee River at Macon, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.2	6.2	3.5	9.2	3.2	2.2	3.3	8.2	4.7	4.8	2.9	2.8
2	4.8	6.0	3.4	8.0	3.1	2.1	2.4	6.5	6.7	16.6	2.9	2.7
3	5.0	5.4	4.2	6.9	3.0	2.0	2.5	5.6	8.5	17.6	2.9	2.8
4	16.1	5.3	4.2	6.1	3.3	3.4	2.8	4.9	6.9	18.2	2.8	2.9
5	15.3	4.9	4.5	5.7	3.4	5.2	2.9	8.1	4.5	17.6	2.9	2.9
6	14.2	4.8	4.1	5.4	3.4	3.0	2.6	7.1	3.7	12.9	2.9	2.8
7	10.5	4.5	3.8	5.2	3.5	2.4	2.4	6.6	3.5	13.3	2.9	2.9
8	9.9	4.9	4.1	5.0	4.8	2.1	2.3	9.2	3.0	9.3	2.8	3.0
9	7.3	6.5	9.7	4.9	4.8	2.0	3.5	5.0	2.5	7.2	2.8	3.1
10	6.4	5.6	11.0	5.5	4.0	2.1	6.6	3.8	2.4	6.0	2.8	2.9
11	6.4	5.3	8.5	6.3	3.4	2.1	4.9	3.5	2.7	5.1	2.7	2.9
12	5.9	5.0	6.9	5.7	3.2	2.0	3.6	3.0	2.6	4.5	2.8	4.0
13	7.0	5.0	6.2	5.1	3.2	13.5	3.3	3.2	3.2	4.2	2.9	4.2
14	6.6	4.8	5.2	4.8	3.1	18.0	2.9	4.4	5.0	4.1	2.9	3.6
15	6.3	4.5	8.7	5.0	2.9	17.2	4.3	11.2	3.2	3.8	3.2	3.4
16	5.4	4.2	14.1	4.8	2.8	17.0	4.5	9.5	2.6	3.8	3.6	3.2
17	5.1	4.1	14.5	4.5	2.7	13.4	4.5	5.3	2.3	3.6	3.5	3.0
18	5.0	4.1	11.8	4.2	2.6	12.9	4.8	4.2	2.2	3.6	3.5	3.4
19	4.8	4.0	9.5	4.1	2.5	10.4	7.7	4.1	6.2	3.8	5.5	4.1
20	4.7	3.9	16.3	4.0	2.5	8.0	10.5	3.3	7.2	4.6	5.4	6.1
21	4.7	4.1	17.0	3.9	2.3	5.9	9.2	3.2	8.1	4.5	4.8	5.6
22	5.2	4.9	15.9	3.9	2.3	5.1	6.3	4.4	9.8	3.8	4.1	5.2
23	19.9	4.0	12.5	3.8	2.4	5.1	7.9	7.3	7.6	3.7	3.9	4.5
24	14.3	3.9	9.9	3.5	2.4	4.0	10.0	7.8	7.4	3.5	3.6	3.9
25	11.3	3.9	8.2	3.3	2.2	3.5	9.0	5.1	8.5	3.5	3.4	3.6
26	11.9	3.9	7.0	3.3	2.4	3.2	6.4	3.8	8.2	3.4	3.1	3.3
27	12.0	3.8	6.3	3.3	2.2	3.2	5.9	4.6	5.5	3.2	3.1	3.2
28	11.0	3.6	11.0	3.2	3.2	3.1	4.2	5.6	6.7	3.1	3.0	3.1
29	9.6	.....	11.9	3.3	3.2	2.8	3.7	9.8	5.9	3.0	2.9	3.6
30	8.5	.....	10.3	3.3	2.9	2.6	8.3	8.5	5.4	2.9	2.8	5.1
31	7.2	.....	10.7	.....	2.5	.....	9.2	7.7	.....	2.9	.....	6.8

Rating table for Ocmulgee River at Macon, Ga., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	1,075	3.50	1,750	5.00	2,610	8.00	4,580
2.10	1,110	3.60	1,800	5.20	2,730	9.00	5,340
2.20	1,150	3.70	1,855	5.40	2,850	10.00	6,240
2.30	1,190	3.80	1,910	5.60	2,980	11.00	7,270
2.40	1,230	3.90	1,965	5.80	3,110	12.00	8,400
2.50	1,270	4.00	2,020	6.00	3,240	13.00	9,600
2.60	1,315	4.10	2,075	6.20	3,372	14.00	10,900
2.70	1,360	4.20	2,130	6.40	3,504	15.00	12,300
2.80	1,405	4.30	2,190	6.60	3,636	16.00	13,800
2.90	1,450	4.40	2,250	6.80	3,768	17.00	15,400
3.00	1,500	4.50	2,310	7.00	3,900	18.00	17,100
3.10	1,550	4.60	2,370	7.20	4,032	19.00	18,900
3.20	1,600	4.70	2,430	7.40	4,164	20.00	20,800
3.30	1,650	4.80	2,490	7.60	4,300		
3.40	1,700	4.90	2,550	7.80	4,440		

NOTE.—The above table is based on discharge measurements made during 1903–1906 and is fairly well defined.

Monthly discharge of Ocmulgee River at Macon, Ga., for 1906.

[Drainage area, 2,420 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	20,600	2,430	5,820	2.40	2.77
February	3,570	1,800	2,430	1.00	1.04
March	15,400	1,700	5,980	2.47	2.85
April	5,520	1,600	2,500	1.06	1.18
May	2,490	1,150	1,520	.628	.72
June	17,100	1,080	4,170	1.72	1.92
July	6,740	1,190	2,890	1.19	1.37
August	7,490	1,500	3,300	1.36	1.57
September	6,060	1,150	2,860	1.18	1.32
October	17,500	1,450	4,510	1.86	2.14
November	2,920	1,360	1,670	.690	.77
December	3,770	1,360	1,890	.781	.90
The year	20,600	1,080	3,300	1.36	18.55

NOTE.—Values for 1906 are good.

ALCOVY RIVER NEAR STEWART, GA.

This station was established September 16, 1905. It is located at a single-span steel wagon bridge known as "Waters Bridge," about 15 miles south of Covington, Ga., and 5 miles from Stewart, Ga. The bridge is below the mouth of Bear Creek and about 4 miles from the mouth of the river. The station is important because it is a short distance below a large amount of fall at the old Newton factory site. The gage which was read during 1906 by C. M. Fincher is attached to a birch tree on the right edge of stream, 40 feet upstream from bridge. Rocks on which bench mark is cut are about 20 feet above bridge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 61, and in Water-Supply Paper No. 197.

Discharge measurements of Alcovy River near Stewart, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 13	W. E. Hall	73	255	4.80	580
January 13	do	73	259	4.82	600
April 13	F. A. Murray	72	209	4.22	483
June 28	W. E. Hall	54	122	2.80	242
August 15	M. R. Hall	75	341	5.64	810
October 31	do	59	121	3.02	242

Daily gage height, in feet, of Alcovy River near Stewart, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.05	4.5	3.2	5.5	2.95	2.6	2.75	6.0	6.5	4.3	2.9	3.0
2	3.9	4.8	3.2	5.1	3.1	2.5	2.65	6.0	4.5	10.4	2.9	3.0
3	7.0	4.4	3.2	4.0	3.05	2.75	2.8	5.8	4.0	8.5	2.85	3.0
4	8.0	4.2	3.5	4.2	3.0	4.0	2.75	4.5	3.1	9.0	3.0	3.0
5	7.0	4.1	3.6	4.1	3.0	3.1	2.85	4.0	2.8	8.5	3.0	3.0
6	8.0	4.0	3.5	4.0	3.1	2.75	2.9	4.2	2.75	9.0	3.0	3.0
7	7.5	4.0	3.5	4.0	3.3	2.7	2.7	4.0	2.7	6.5	3.0	3.0
8	7.0	3.9	4.4	3.9	3.6	2.6	2.9	3.8	2.7	5.8	3.0	3.25
9	5.8	4.0	4.9	3.9	3.8	2.6	6.6	3.5	2.6	5.3	3.0	3.25
10	4.7	4.0	5.0	3.85	3.65	2.5	7.2	3.1	2.5	4.8	3.0	3.25
11	4.6	3.9	5.5	4.3	3.35	2.5	5.0	3.0	2.6	4.0	3.0	3.5
12	4.5	3.9	5.5	4.5	3.1	2.6	4.1	2.9	2.5	3.8	3.15	3.75
13	4.5	3.85	4.8	4.3	3.0	10.5	3.4	8.0	3.3	3.6	3.2	3.7
14	4.4	3.8	4.0	3.9	2.9	10.5	3.5	5.0	3.25	3.5	3.2	3.7
15	4.4	3.8	6.5	3.75	2.8	10.0	3.5	6.2	3.0	3.4	3.3	3.7
16	4.6	3.7	6.2	3.7	2.75	11.0	3.7	6.0	3.1	3.3	3.35	3.4
17	4.5	3.7	6.8	3.6	2.65	11.5	4.4	5.0	2.9	3.3	3.4	3.4
18	4.2	3.5	7.0	3.55	2.6	11.0	6.8	4.0	6.5	3.4	4.8	3.6
19	4.1	3.45	8.0	3.5	2.6	8.5	7.0	3.5	6.0	3.5	4.4	3.6
20	3.9	3.4	8.0	3.4	2.55	6.5	6.5	3.0	5.5	3.6	4.0	4.0
21	4.0	3.85	9.5	3.3	2.5	5.0	5.8	2.9	4.5	3.5	4.0	4.0
22	4.9	3.6	9.0	3.3	2.65	4.0	5.0	2.9	6.0	3.55	3.9	4.3
23	7.5	3.5	8.0	3.2	2.9	3.75	7.0	3.4	8.0	3.4	3.65	4.3
24	7.0	3.45	6.5	3.1	2.8	3.45	5.0	3.25	6.8	3.35	3.4	4.1
25	6.5	3.45	5.5	3.1	2.6	3.1	4.8	3.1	4.5	3.3	3.3	(a)
26	6.5	3.4	5.0	3.0	2.8	2.9	5.5	3.7	4.6	3.2	3.2	.....
27	6.2	3.35	4.9	3.0	3.0	2.9	4.5	4.0	6.0	3.1	3.2	.....
28	6.1	3.25	5.5	3.0	3.25	2.9	3.5	3.0	4.5	3.1	3.15	.....
29	6.0	.....	4.9	3.0	3.9	2.8	5.5	3.0	4.4	3.1	3.1	.....
30	5.5	.....	5.4	2.95	3.25	2.8	5.0	3.0	4.4	3.0	3.05	.....
31	5.0	.....	6.0	.....	2.8	.....	4.8	3.6	.....	3.0	.....	.....

a No records after December 24.

Rating table for Alcovy River near Stewart, Ga., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.50	170	3.50	334	4.50	530	6.00	910
2.60	185	3.60	352	4.60	552	6.20	970
2.70	200	3.70	370	4.70	585	6.40	1,030
2.80	216	3.80	388	4.80	608	6.60	1,090
2.90	232	3.90	406	4.90	631	6.80	1,150
3.00	248	4.00	425	5.00	645	7.00	1,210
3.10	265	4.10	445	5.20	693	7.20	1,274
3.20	282	4.20	466	5.40	743	7.40	1,338
3.30	299	4.30	487	5.60	796	7.60	1,402
3.40	316	4.40	508	5.80	852	7.80	1,466

NOTE.—The above table is based on ten discharge measurements made during 1905–6 and is fairly well defined below gage height 5.7 feet. Above gage height 7.0 feet the rating curve is a tangent, the difference being 32 per tenth.

Monthly discharge of Alcovy River near Stewart, Ga., for 1906.

[Drainage area, 395 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	1,530	406	818	2.07	2.39
February	608	290	393	.995	1.04
March	2,010	282	824	2.09	2.41
April	768	240	383	.970	1.08
May	406	170	252	.638	.74
June	2,650	170	764	1.93	2.15
July	1,270	192	582	1.47	1.70
August	1,530	232	481	1.22	1.41
September	1,530	170	518	1.31	1.46
October	2,300	248	635	1.61	1.86
November	608	224	305	.772	.86
December (1-24)	487	248	335	.848	.76
The period	2,650	170	524	1.32	17.86

NOTE.—Values for 1906 are excellent.

APALACHEE RIVER NEAR BUCKHEAD, GA.

This station was established February 13, 1901. It is located at the iron wagon bridge over Apalachee River, about 3½ miles north of Buckhead, Ga. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 63, and in Water-Supply Paper No. 197, where are given also data for previous years.

Discharge measurements of Apalachee River near Buckhead, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 10	Hall and Murphy	86	386	3.28	645
April 28	M. R. Hall	85	309	2.51	488
June 28	do	82	239	2.01	333
August 17	do	85	368	3.36	714
October 17	do	83	221	1.99	325

Daily gage height, in feet, of Apalachee River near Buckhead, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.5	4.2	2.5	4.9	2.9	2.05	2.3	9.0	2.6	3.5	2.3	2.1
2	4.2	3.9	2.55	4.3	2.6	2.0	2.1	5.4	4.0	4.8	2.35	2.15
3	4.8	3.6	2.7	3.8	2.35	4.5	2.5	3.8	3.2	5.7	2.3	2.2
4	13.0	3.4	2.95	3.6	2.3	3.6	3.1	4.3	2.5	7.2	2.3	2.3
5	14.2	3.3	2.7	3.4	2.4	2.6	2.5	6.2	2.35	6.1	2.3	2.3
6	9.8	3.4	2.7	3.3	2.3	2.35	2.0	4.2	2.25	4.8	2.3	2.3
7	6.4	3.4	2.9	3.2	3.3	2.2	2.15	3.5	2.2	3.5	2.3	2.4
8	5.2	3.5	3.7	3.0	4.4	2.1	3.6	3.4	2.15	3.1	2.3	2.5
9	4.9	3.4	6.3	2.95	3.7	2.0	10.0	3.6	1.9	2.7	2.35	2.2
10	4.1	3.3	6.4	4.8	2.8	2.05	8.7	2.7	1.7	2.65	2.35	2.35
11	3.3	3.3	4.3	4.1	2.45	2.1	3.5	2.85	2.0	2.55	2.35	2.85
12	3.8	3.2	2.5	3.5	2.3	2.3	3.6	2.65	2.35	2.5	2.6	3.4
13	4.7	3.1	2.85	3.1	2.25	7.6	2.9	2.4	3.1	2.4	2.55	3.0
14	4.2	3.0	3.0	2.5	2.2	11.5	2.4	2.7	2.7	2.2	2.5	2.75
15	3.7	3.0	7.0	3.9	2.15	13.1	4.2	7.0	2.3	2.2	2.6	2.6
16	3.5	2.95	12.5	3.4	2.15	13.2	6.7	7.7	1.9	2.3	2.55	2.2
17	3.4	2.8	10.5	3.1	2.1	10.5	5.4	3.6	1.7	2.2	2.5	1.9
18	3.1	2.8	6.0	2.9	2.1	13.9	7.5	3.1	2.1	2.15	3.0	2.45
19	3.0	2.6	7.2	2.75	2.1	8.0	9.6	3.8	5.7	2.5	3.5	2.6
20	3.1	2.7	14.8	2.6	2.0	4.0	5.8	3.0	6.0	2.7	3.8	3.5

Daily gage height, in feet, of Apalachee River near Buckhead, Ga., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	2.9	3.1	15.3	2.6	1.9	3.4	4.1	2.9	6.8	2.5	3.1	3.8
22	6.3	3.2	9.4	2.6	2.05	3.0	3.2	2.8	5.2	2.3	2.7	3.5
23	19.9	3.9	5.7	2.45	2.05	2.8	6.0	2.85	4.3	2.45	2.65	3.1
24	15.1	2.75	4.7	2.45	2.1	2.6	5.8	2.95	3.8	2.45	2.6	2.6
25	8.0	2.7	3.6	2.5	2.2	2.4	6.4	3.1	3.4	2.5	2.45	2.4
26	7.8	2.7	3.0	2.5	2.35	3.4	3.2	2.4	3.3	2.4	2.4	2.35
27	9.4	2.7	3.1	2.5	2.55	2.85	2.7	3.4	3.5	2.3	2.4	2.3
28	8.3	2.6	4.5	2.6	2.5	2.45	2.55	3.6	3.6	2.3	2.4	2.85
29	6.8	.....	5.1	3.0	2.4	2.4	3.0	3.5	3.8	2.3	2.3	3.55
30	5.5	.....	5.2	4.1	2.2	2.3	6.2	3.6	3.1	2.35	2.15	3.8
31	4.8	.....	6.9	.....	2.1	.....	8.2	2.95	.....	2.2	.....	4.6

Rating table for Apalachee River near Buckhead, Ga., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.70	264	2.20	384	2.70	520	3.20	670
1.80	286	2.30	410	2.80	550	3.30	700
1.90	310	2.40	436	2.90	580	3.40	730
2.00	334	2.50	464	3.00	610	3.50	760
2.10	358	2.60	492	3.10	640		

NOTE.—The above table is based on discharge measurements made during 1903-1906, and is fairly well defined below gage height 7.3 feet. Above gage height 3 feet the rating curve is a tangent, the difference being 30 per tenth.

Monthly discharge of Apalachee River near Buckhead, Ga., for 1906.

[Drainage area, 440 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	5,680	580	1,650	3.75	4.32
February	970	492	658	1.50	1.56
March	4,300	464	1,380	3.14	3.62
April	1,180	450	675	1.53	1.71
May	1,030	310	449	1.02	1.18
June	3,880	334	1,110	2.52	2.81
July	2,710	334	1,090	2.48	2.86
August	2,410	436	894	2.03	2.34
September	1,750	264	674	1.53	1.71
October	1,870	371	623	1.42	1.64
November	850	371	478	1.09	1.22
December	1,090	310	538	1.22	1.41
The year	5,680	264	852	1.94	26.38

NOTE.—At times the accuracy of the above results may be more or less affected by daily fluctuations caused by stored water above, but otherwise the results can, in general, be accepted as excellent.

OCONEE RIVER NEAR GREENSBORO, GA.

This station was established July 25, 1903. It is located at the new wagon bridge, about 5 miles west of Greensboro, on the road to Madison, Ga. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 66, and in Water-Supply Paper No. 197, where are given also data for previous years.

Discharge measurements of Oconee River near Greensboro, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 10	M. R. Hall	122	861	3.62	1,310
April 28	do	122	843	4.35	1,710
June 28	do	118	471	2.13	835
August 17	do	121	863	5.75	2,500
October 17	do	118	514	2.70	961

Daily gage height, in feet, of Oconee River near Greensboro, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.5	5.1	3.6	5.6	3.4	2.0	1.8	8.4	5.6	3.5	2.5	2.3
2	3.5	5.0	3.6	5.4	3.0	1.8	4.9	8.4	3.6	5.7	2.5	2.3
3	3.8	4.9	3.8	5.4	2.7	4.3	2.6	3.7	2.8	6.1	2.4	2.3
4	13.9	4.5	3.5	5.2	2.9	5.6	3.3	9.5	2.6	8.7	2.4	2.3
5	16.3	3.8	3.4	5.0	2.9	3.3	2.1	7.7	2.3	10.2	2.3	2.2
6	16.8	3.6	3.2	4.0	2.9	2.3	2.0	6.2	2.4	9.3	2.4	2.3
7	12.5	3.8	2.0	4.1	5.2	2.1	2.1	5.2	3.6	5.8	2.5	2.4
8	9.3	4.0	2.8	3.6	4.6	2.0	6.5	3.7	2.6	4.2	2.4	2.4
9	5.1	3.8	4.3	3.4	3.7	1.7	7.6	3.1	2.2	3.6	2.4	2.3
10	4.8	3.7	8.2	5.5	3.0	2.3	8.2	2.8	2.2	3.4	2.4	2.3
11	4.5	3.7	4.9	4.0	2.6	2.0	4.5	2.6	2.7	3.2	2.3	4.1
12	4.7	3.5	4.5	3.7	2.5	3.7	3.7	2.5	2.6	3.0	2.6	4.9
13	5.2	3.5	3.0	3.7	2.5	8.6	3.1	2.6	5.6	2.9	2.5	4.0
14	5.2	3.3	2.8	4.0	2.4	10.8	2.6	3.4	3.7	2.8	2.6	3.1
15	5.1	3.2	8.6	4.1	2.3	12.3	7.4	5.2	2.5	2.8	2.9	2.8
16	4.3	3.1	13.5	4.2	2.3	10.4	7.9	5.7	2.2	2.8	2.8	2.7
17	4.3	3.1	16.3	3.5	2.2	11.3	7.5	5.3	2.0	2.7	2.7	2.7
18	4.0	3.0	15.2	3.2	2.2	7.4	10.3	4.1	2.3	2.7	3.8	3.3
19	3.4	3.0	10.1	3.1	2.1	4.5	12.3	4.3	5.3	3.7	3.7	4.3
20	3.6	2.9	14.9	3.0	2.0	3.4	9.9	5.1	8.4	4.3	3.4	4.9
21	3.6	2.9	18.5	3.0	1.9	3.1	5.4	6.8	8.4	3.5	2.9	4.9
22	6.5	3.4	18.1	2.9	2.3	2.8	3.8	8.2	8.0	3.0	2.8	4.1
23	16.5	3.0	10.5	2.8	2.1	2.6	8.2	5.9	6.1	2.9	2.8	3.4
24	18.9	3.0	6.1	2.7	1.9	2.2	7.5	4.0	4.0	2.7	2.6	3.1
25	16.2	3.0	6.0	2.6	1.9	2.2	5.0	3.4	4.8	2.7	2.5	2.9
26	11.3	3.9	5.8	2.6	2.3	3.0	4.3	4.0	4.1	2.7	2.5	2.8
27	10.4	3.8	5.5	2.5	2.6	2.4	3.0	4.6	5.8	2.5	2.5	2.7
28	9.8	3.8	5.8	4.2	3.2	2.3	2.9	4.7	5.9	2.5	2.4	2.6
29	8.6	.....	5.6	4.7	2.3	2.1	3.5	4.9	5.3	2.5	2.4	4.0
30	7.0	.....	5.6	4.2	2.2	2.0	6.9	5.8	3.8	2.8	2.2	3.6
31	6.3	.....	5.5	.....	1.9	.....	11.0	4.9	.....	2.5	.....	5.8

Rating table for Oconee River near Greensboro, Ga., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.70	620	3.00	1,090	4.30	1,670	6.20	2,660
1.80	655	3.10	1,130	4.40	1,720	6.40	2,770
1.90	690	3.20	1,170	4.50	1,770	6.60	2,880
2.00	725	3.30	1,210	4.60	1,820	6.80	3,000
2.10	760	3.40	1,250	4.70	1,870	7.00	3,120
2.20	795	3.50	1,295	4.80	1,920	8.00	3,740
2.30	830	3.70	1,340	4.90	1,970	9.00	4,410
2.40	865	3.70	1,385	5.00	2,020	10.00	5,110
2.50	900	3.80	1,430	5.20	2,120	11.00	5,840
2.60	935	3.90	1,475	5.40	2,220	12.00	6,590
2.70	970	4.00	1,520	5.60	2,330		
2.80	1,010	4.10	1,570	5.80	2,440		
2.90	1,050	4.20	1,620	6.00	2,550		

NOTE.—The above table is based on discharge measurements made during 1903–1906 and is well defined below gage height 10.5 feet. Above gage height 10.4 feet the rating curve is a tangent, the difference being 75 per tenth.

Monthly discharge of Oconee River near Greensboro, Ga., for 1906.

[Drainage area, 1,100 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	11,800	1,250	4,100	3.73	4.30
February	2,070	1,010	1,330	1.21	1.26
March	11,500	725	3,640	3.31	3.82
April	2,330	900	1,480	1.35	1.51
May	2,120	690	971	.883	1.02
June	6,820	620	1,860	1.69	1.89
July	6,820	655	2,480	2.25	2.59
August	4,760	900	2,120	1.93	2.22
September	4,000	725	1,670	1.52	1.70
October	5,250	900	1,590	1.45	1.67
November	1,430	795	955	.868	.97
December	2,440	795	1.210	1.10	1.27
The year	11,800	620	1,950	1.77	24.22

NOTE.—Values for 1906 are excellent.

OCONEE RIVER AT FRALEYS FERRY, NEAR MILLEDGEVILLE, GA.

This station is located at Fraleys Ferry, about 6 miles above Milledgeville, Ga., and about 4 miles below the mouth of Little River. This point, being above the dam at Milledgeville, has a nearly natural flow, being but slightly affected by dams a great distance upstream.

The channel is straight for some distance above and below the station. The current is moderate or slow at low stages. The bed is sandy and changing, but the rock shoals below will probably control the water level at the station.

Discharge measurements are made from the ferryboat or from a small boat controlled by the ferry cable, along which the distances are marked. Measurements can be made at low and medium stages only, as at higher stages the current soon becomes too swift for safety in boat measurements.

The gage is a heart-pine timber bolted to solid rock on the left bank 100 feet above the ferry and capped with a 1 by 2 inch walnut gage, which reads from 4.1 feet to 9 feet. The gage is read twice a day by Jesse Cummings. The bench mark is a point and circle cut into solid rock on the left bank 35 feet from edge of water and 20 feet above the ferry cable; elevation, 17.02 feet above gage datum. These are set to accord with the former temporary gage used during October and November, 1905.

Discharge measurements of Oconee River at Fraleys Ferry, near Milledgeville, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 23	F. A. Murray	273	1,960	5.59	1,540
October 12	W. E. Hall	276	1,910	6.02	2,200

Daily gage height, in feet, of Oconee River at Fraleys Ferry, near Milledgeville, Ga., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.4	5.6	8.8	6.8	7.2	5.6	5.6
2	.....	5.4	5.6	8.2	7.2	(a)	5.6	5.6
3	.....	5.6	6.0	7.5	6.8	(a)	5.6	5.7
4	.....	6.8	6.8	7.7	6.0	8.7	5.6	5.7
5	.....	6.8	6.3	7.9	5.8	8.4	5.6	5.6
6	.....	5.9	5.6	7.3	5.6	8.8	5.6	5.7
7	.....	5.6	6.4	7.0	5.5	8.0	5.6	5.8
8	.....	5.6	6.9	6.6	5.5	7.0	5.6	5.8
9	.....	5.5	8.6	6.3	5.5	6.4	5.6	5.7
10	.....	5.6	8.8	6.0	5.4	6.2	5.6	5.8
11	.....	5.6	7.4	5.8	5.6	6.2	5.6	5.9
12	.....	5.9	6.3	5.8	5.6	6.0	5.7	6.5
13	.....	(a)	6.2	6.0	6.6	6.0	5.8	6.4
14	.....	(a)	7.0	6.4	6.6	5.9	5.7	6.1
15	.....	(a)	7.9	7.4	6.0	5.9	5.9	6.0
16	.....	(a)	8.2	7.8	5.5	5.9	6.0	5.8
17	.....	(a)	7.9	8.2	5.4	5.8	6.1	5.9
18	.....	(a)	8.4	7.0	5.9	5.9	6.1	6.0
19	.....	8.6	11.0	6.4	7.2	6.0	6.4	7.3
20	.....	7.4	8.2	6.8	8.0	6.4	6.6	7.4
21	.....	6.6	7.2	7.3	8.0	6.2	6.2	7.0
22	.....	7.0	7.4	7.1	7.8	6.0	6.0	6.7
23	5.6	6.8	7.2	6.8	7.0	5.9	5.9	6.4
24	5.5	6.0	8.0	6.6	7.1	5.8	5.8	6.2
25	5.5	5.8	7.2	6.2	7.1	5.8	5.8	6.0
26	5.6	5.8	6.6	6.2	6.6	5.8	5.7	5.9
27	5.8	6.2	6.2	5.4	7.2	5.8	5.6	5.9
28	6.0	5.9	6.0	7.2	7.5	5.7	5.6	5.9
29	5.9	5.6	6.6	6.8	7.0	5.6	5.7	6.6
30	5.7	5.6	8.5	7.0	6.6	5.6	5.6	6.8
31	5.5	.....	8.8	6.8	.....	5.6	.....	7.6

a Water over the gage.

Rating table for Oconee River at Fraleys Ferry near Milledgeville, Ga., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.30	530	5.00	1,000	5.70	1,770	6.40	2,860
4.40	580	5.10	1,090	5.80	1,900	6.50	3,040
4.50	640	5.20	1,190	5.90	2,040	6.60	3,220
4.60	700	5.30	1,290	6.00	2,190	6.70	3,410
4.70	770	5.40	1,400	6.10	2,350	6.80	3,600
4.80	840	5.50	1,520	6.20	2,520	6.90	3,800
4.90	920	5.60	1,640	6.30	2,690	7.00	4,000

NOTE.—The above table is based on five discharge measurements made during 1904–1906, and is well defined below gage height 6 feet.

OCONEE RIVER AT DUBLIN, GA.

A station was established by the United States Weather Bureau in 1894 at Dublin, Ga., about 60 miles above the junction of the Oconee with the Ocmulgee. Records were kept, with the exception of the summer months of 1896, until April 30, 1897, when the station was discontinued. In 1898 discharge measurements were commenced by the United States Geological Survey, and February 11 an observer was employed to read the gage. October 15, 1898, the Weather Bureau again adopted the station and has maintained the gage and furnished gage heights to the Geological Survey continuously since that time. The conditions at this station and the bench marks are

described in Water-Supply Paper No. 168, page 71, and in Water-Supply Paper No. 197, where are given also data for previous years.

Discharge measurements of Oconee River at Dublin, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 6	F. A. Murray	237	1,690	3.14	4,320
March 6	do	237	1,690	3.11	4,300
May 28	do	222	957	.82	2,280
September 1	W. E. Hall	258	2,150	5.50	6,560

Daily gage height, in feet, of Oconee River at Dublin, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.9	13.9	3.1	9.7	1.4	1.6	1.3	6.7	5.6	3.9	0.5	1.0
2	6.2	11.8	2.7	10.0	2.4	1.5	.9	7.8	7.5	2.7	.5	.9
3	5.6	8.9	2.7	9.2	2.4	1.5	.9	8.3	5.0	5.6	.2	.7
4	5.6	7.6	2.5	7.7	2.2	1.4	1.9	8.9	4.0	6.8	.2	.8
5	7.5	6.4	3.0	6.5	1.8	1.4	2.5	8.5	3.0	8.2	.7	.8
6	8.5	4.4	3.3	5.0	1.5	1.6	2.9	6.9	2.5	9.1	.7	.7
7	10.0	4.7	3.3	3.5	1.2	1.8	2.6	6.9	2.0	9.1	.6	.7
8	12.6	4.4	3.0	3.0	1.0	2.1	1.9	5.9	1.5	9.8	.5	1.0
9	14.4	5.7	4.0	3.0	1.5	1.8	3.9	4.5	1.5	10.0	.5	1.0
10	14.4	7.2	5.6	2.7	2.3	1.0	4.2	3.4	1.0	10.3	.7	1.0
11	13.3	6.2	6.9	2.5	3.0	.8	4.9	2.5	.9	9.0	.6	1.0
12	10.0	6.9	7.3	4.3	2.2	.6	6.2	1.7	.7	8.0	.6	1.0
13	6.4	6.5	6.5	5.0	1.5	.3	7.1	1.4	.7	4.0	.7	1.7
14	6.0	6.3	4.9	4.2	1.5	.3	6.0	1.5	1.0	2.0	.6	2.7
15	6.1	6.5	4.0	3.3	1.2	5.6	4.5	1.7	1.5	1.5	.7	3.6
16	5.7	5.5	3.5	2.9	.9	7.7	5.8	1.9	2.0	1.0	1.5	2.6
17	4.8	4.9	6.7	3.0	.8	11.1	6.5	2.0	2.5	.3	1.5	1.3
18	4.3	3.9	7.7	3.8	.8	14.7	7.2	2.4	2.0	1.0	1.8	1.5
19	4.4	3.3	9.5	3.2	.7	18.7	7.7	3.4	1.8	1.0	1.7	2.8
20	3.8	3.3	12.5	3.0	.7	18.2	8.0	4.5	1.2	1.5	2.0	2.0
21	3.7	3.5	15.0	2.4	.8	17.0	9.0	5.6	1.9	1.8	2.6	4.5
22	3.4	3.4	15.7	2.0	.9	14.6	9.9	4.8	4.5	2.0	2.8	5.3
23	4.2	4.6	15.7	2.2	1.0	13.0	10.2	5.5	5.0	2.5	2.0	4.5
24	4.5	4.4	16.4	1.8	1.0	6.8	9.0	6.0	6.0	1.5	1.7	3.5
25	9.2	4.0	17.5	1.7	1.2	3.9	8.0	5.0	4.8	1.0	1.5	3.0
26	14.7	3.2	16.7	1.6	1.4	2.0	7.4	4.2	3.8	1.0	1.7	3.0
27	19.1	3.0	14.0	1.4	1.3	1.6	8.0	3.0	3.7	.9	1.0	3.0
28	19.2	3.0	13.1	1.0	1.3	1.5	8.0	3.3	3.4	.7	1.0	1.7
29	18.8	.....	9.0	.9	1.6	2.0	6.0	5.5	3.0	1.0	1.0	1.6
30	17.0	.....	7.8	1.0	1.7	1.6	4.0	6.5	4.8	1.0	1.0	1.5
31	15.2	.....	8.5	.....	1.6	.....	5.0	6.0	.....	.7	.....	2.0

Rating taole for Oconee River at Dublin, Ga., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.20	1,800	1.60	2,945	3.00	4,150	5.80	6,870
.30	1,880	1.70	3,030	3.20	4,330	6.00	7,090
.40	1,960	1.80	3,115	3.40	4,510	7.00	8,190
.50	2,040	1.90	3,200	3.60	4,695	8.00	9,390
.60	2,120	2.00	3,285	3.80	4,885	9.00	10,640
.70	2,200	2.10	3,370	4.00	5,075	10.00	11,990
.80	2,280	2.20	3,455	4.20	5,265	11.00	13,430
.90	2,360	2.30	3,540	4.40	5,455	12.00	14,930
1.00	2,440	2.40	3,625	4.60	5,650	13.00	16,500
1.10	2,520	2.50	3,710	4.80	5,850	14.00	18,100
1.20	2,605	2.60	3,795	5.00	6,050	15.00	19,800
1.30	2,690	2.70	3,880	5.20	6,250		
1.40	2,775	2.80	3,970	5.40	6,450		
1.50	2,860	2.90	4,060	5.60	6,650		

NOTE.—The above table is based on discharge measurements made during 1903-1906, and is well defined below gage height 7 feet. Above gage height 14 feet the rating curve is a tangent, the difference being 170 per tenth.

Monthly discharge of Oconee River at Dublin, Ga., for 1906.

[Drainage area, 4,180 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	26,900	4,510	11,800	2.82	3.25
February	17,900	4,150	6,920	1.66	1.73
March	24,000	3,710	10,400	2.49	2.87
April	12,000	2,360	4,990	1.19	1.33
May	4,150	2,200	2,810	.672	.77
June	26,100	1,880	7,480	1.79	2.00
July	12,300	2,360	6,820	1.63	1.88
August	10,500	2,780	5,910	1.41	1.63
September	8,790	2,200	4,190	1.00	1.12
October	12,400	1,880	5,280	1.26	1.45
November	3,970	1,800	2,540	.608	.68
December	6,350	2,200	3,320	.794	.92
The year	26,900	1,800	6,040	1.44	19.63

NOTE.—Values for 1906 are probably excellent except those for May which are fair, owing to erroneous gage heights.

OHOOPEE RIVER NEAR REIDSVILLE, GA.

This station was established June 13, 1903. It is located at the wooden highway bridge known as Sheppards Bridge, 4½ miles west of Reidsville, Ga. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 75, and in Water-Supply Paper No. 197, where are given also data for previous years.

Discharge measurements of Ohoopee River near Reidsville, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 8	F. A. Murray	128	1,150	7.75	2,220
May 26	do	113	590	3.57	642
August 30	W. E. Hall	133	1,340	9.09	3,130

Daily gage height, in feet, of Ohoopee River near Reidsville, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	8.8	8.7	6.2	6.3	1.1	3.5	4.6	8.6	8.1	3.2	1.2	1.0
2	8.8	8.3	6.0	6.1	1.0	2.8	3.7	8.4	7.2	3.4	1.2	.9
3	8.7	7.9	6.1	5.8	1.0	3.9	3.5	7.6	7.8	4.8	1.0	.9
4	8.9	7.5	7.9	5.5	1.0	5.0	3.5	7.3	7.0	5.2	.9	.8
5	9.0	7.2	8.1	5.1	1.0	7.6	4.7	7.4	6.3	6.5	.9	.8
6	9.1	6.9	7.6	4.7	1.4	9.9	5.0	7.5	5.1	5.0	.9	.7
7	9.3	6.5	7.5	4.4	1.9	9.5	5.1	6.8	4.9	4.7	.8	.7
8	9.6	6.5	7.7	4.1	2.9	8.9	5.8	5.9	4.3	4.3	.8	.9
9	9.2	7.2	8.1	3.7	3.5	7.8	6.0	4.3	3.8	4.0	.8	1.2
10	8.8	8.0	8.4	3.5	3.5	6.2	5.2	4.6	3.4	3.9	.8	1.7
11	8.3	8.5	8.2	3.3	3.3	4.4	4.2	4.0	2.9	3.7	.7	1.6
12	8.0	8.9	8.2	3.3	2.8	4.1	4.5	3.3	2.3	3.1	.7	1.4
13	7.7	9.2	8.0	3.0	2.0	6.0	4.2	3.6	2.9	2.7	.8	1.2
14	7.3	9.4	7.6	2.9	1.7	7.4	4.5	3.2	2.6	2.5	.8	1.0
15	7.1	9.5	7.1	3.0	1.5	8.4	4.9	2.9	3.7	2.3	.9	1.0
16	7.0	9.3	6.8	3.2	1.4	7.9	5.0	3.1	3.8	2.1	1.2	1.0
17	6.8	9.0	6.4	3.7	1.2	10.1	5.9	3.9	3.9	2.0	1.6	1.0
18	6.6	8.7	6.1	3.4	1.0	10.6	6.6	4.3	3.8	2.0	1.7	1.0
19	6.6	8.1	5.8	3.0	1.0	10.6	7.0	3.4	3.6	2.1	1.8	1.2
20	6.6	7.6	6.9	2.8	.9	11.0	7.8	2.9	3.4	2.3	1.8	1.7

Daily gage height, in feet, of Ohoopee River near Reidsville, Ga., for 1906 Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	6.3	7.5	7.6	2.7	.9	10.9	9.2	2.3	3.9	2.4	1.9	2.0
22	6.1	8.1	8.0	2.4	.9	10.0	8.4	2.8	3.4	2.4	1.8	2.3
23	6.5	8.2	8.7	2.2	.9	9.2	7.6	3.1	3.2	2.3	1.7	2.3
24	7.0	8.0	9.0	2.0	1.3	8.1	7.3	4.1	3.1	2.3	1.6	2.3
25	7.5	7.6	8.6	1.8	2.5	7.2	7.3	4.8	2.9	2.1	1.6	2.3
26	8.0	7.2	7.7	1.7	3.5	6.5	7.5	5.2	2.7	2.0	1.6	2.3
27	8.5	6.8	7.2	1.5	4.0	5.9	7.2	6.7	3.1	1.9	1.5	2.0
28	9.0	6.5	6.8	1.4	4.5	5.5	6.9	8.1	3.4	1.8	1.2	2.0
29	9.4	.....	6.8	1.3	4.8	5.3	7.8	8.6	3.5	1.7	1.1	2.0
30	9.3	.....	6.7	1.2	5.1	5.2	8.6	9.1	3.3	1.6	1.0	2.1
31	9.0	.....	6.7	.....	4.4	.....	9.0	8.9	.....	1.6	.....	2.4

Rating table for Ohoopee River near Reidsville, Ga., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.70	83	2.10	283	3.50	600	5.80	1,438
.80	93	2.20	302	3.60	629	6.00	1,520
.90	104	2.30	321	3.70	659	6.20	1,602
1.00	115	2.40	341	3.80	690	6.40	1,685
1.10	127	2.50	361	3.90	722	6.60	1,771
1.20	140	2.60	382	4.00	755	6.80	1,860
1.30	153	2.70	403	4.20	824	7.00	1,950
1.40	167	2.80	425	4.40	895	8.00	2,430
1.50	182	2.90	447	4.60	968	9.00	2,950
1.60	197	3.00	470	4.80	1,043	10.00	3,500
1.70	213	3.10	494	5.00	1,120	11.00	4,120
1.80	230	3.20	519	5.20	1,198		
1.90	247	3.30	545	5.40	1,277		
2.00	265	3.40	572	5.60	1,357		

NOTE.—The above table is based on discharge measurements made during 1903–1906 and is well defined.

Monthly discharge of Ohoopee River near Reidsville, Ga., for 1906.

[Drainage area, 1,280 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	3,280	1,560	2,470	1.93	2.22
February	3,220	1,730	2,420	1.89	1.97
March	2,950	1,440	2,140	1.67	1.92
April	1,640	140	619	.484	.54
May	1,160	104	359	.280	.32
June	4,120	425	2,210	1.73	1.93
July	3,060	600	1,600	1.25	1.44
August	3,000	321	1,370	1.07	1.23
September	2,480	321	858	.670	.75
October	1,730	197	520	.406	.47
November	247	83	146	.114	.13
December	341	83	189	.148	.17
The year	4,120	83	1,240	.970	13.09

NOTE.—Values are rated as follows: January to April and June to October, excellent; May, November, and December, good.

ST. JOHNS RIVER DRAINAGE BASIN.

SILVER SPRINGS AT SILVER SPRINGS, FLA.

Silver Springs form the outlet of an underground stream or system of streams so large that steamboats run on the stream leading from it into the basin of the spring. This water flows eastward about 9 miles into the Oklawaha River, which has its source in a number of lakes in central Florida, and flows north for a considerable distance, then eastward into the St. Johns River, which empties into the Atlantic Ocean.

On May 25, 1906, a station was established at Silver Springs for the purpose of observing the amount and fluctuation of the flow from this remarkable spring. The vertical gage is attached to a post in the basin, and discharge measurements are made from a boat at a point on the outlet stream just below.

The bed of the stream is sandy and is covered with vegetation, making it difficult to measure. At the point usually measured the width is about 100 feet, with a depth of 10 feet.

A measurement was made May 26, 1906, by W. E. Hall, with the following results:

Width, 110 feet; area, 876 square feet; gage height, 3.02 feet; discharge, 545 second-feet.

Daily gage height, in feet, of Silver Springs at Silverspring, Fla., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1			3.45	4.2	4.35	3.15	3.8	3.7
2			3.45	4.2	4.35	3.1	3.8	3.7
3		3.05	3.45	4.05	4.35	3.1	3.8	3.7
4		3.0	3.45	4.0	4.3	3.05	3.8	3.7
5		3.0	3.45	4.0	4.3	3.05	3.8	3.7
6		3.0	3.5	4.0	4.25	3.05	3.8	3.7
7		3.0	3.5	3.95	4.2	3.05	3.8	3.7
8		3.0	3.5	3.95	4.2	3.0	3.85	3.65
9		3.05	3.5	3.95	4.2	3.0	3.85	3.65
10		3.15	3.5	3.9	4.15	3.0	3.85	3.65
11		3.15	3.55	3.9	4.1	3.0	3.8	3.6
12		3.35	3.6	3.95	4.1	3.25	3.8	3.6
13		3.6	3.7	4.0	4.1	3.4	3.8	3.6
14		3.4	3.75	4.05	4.05	3.6	3.8	3.6
15		3.4	3.8	4.05	4.05	3.75	3.8	3.6
16		3.4	3.85	4.1	4.05	3.85	3.8	3.6
17		3.45	4.1	4.05	4.05	3.9	3.75	3.6
18		3.5	4.1	4.0	4.0	3.9	3.75	3.6
19		3.5	4.05	4.05	4.0	3.9	3.75	3.6
20		3.45	4.05	4.1	3.05	3.9	3.75	3.6
21		3.45	4.0	4.15	3.05	3.9	3.75	3.6
22		3.45	4.0	4.2	3.05	3.9	3.75	3.6
23		3.45	4.05	4.2	3.05	3.85	3.75	3.6
24		3.45	4.1	4.2	3.1	3.85	3.75	3.55
25	3.0	3.45	4.1	4.25	3.1	3.85	3.75	3.55
26	3.1	3.4	4.2	4.3	3.1	3.8	3.75	3.55
27	3.1	3.4	4.05	4.3	3.05	3.8	3.75	3.55
28	3.1	3.45	4.05	4.35	3.05	3.8	3.7	3.55
29	3.1	3.45	4.0	4.4	3.05	3.8	3.7	3.5
30	3.05	3.45	4.05	4.4	3.1	3.8	3.7	3.5
31	3.05		4.1	4.35		3.8		3.5

EASTERN GULF STATES DRAINAGES.

WITHLACOOCHEE RIVER (OF FLORIDA) DRAINAGE BASIN.

MISCELLANEOUS MEASUREMENT.

The following miscellaneous discharge measurement was made on Withlacoochee River May 24, 1906, at an old wagon bridge about 10 miles southeast of Dade City, Fla.:

Width, 25 feet; area, 26 square feet; discharge, 11 second-feet.

SUWANEE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Suwanee River and its principal tributary, Withlacoochee River of Georgia, drain a considerable area in the southern-central portion of Georgia. These unite after passing into Florida and continue a southerly course to the Gulf of Mexico, about 10 miles north of Cedar Keys. The eastern branch—Suwanee River—drains a portion of the Okefinokee Swamp, in Georgia, and Santa Fe River, a tributary from the east, coming in lower down, drains the upper central portion of Florida lying west of St. Johns River.

SUWANEE RIVER AT WHITE SPRINGS, FLA.

This station was established on May 28, 1906. It is located at the county bridge, in the town of White Springs, about 600 feet above the point where the flow from White Spring enters the river.

Measurements are made from the single-span steel bridge and the trestle approaches.

The standard chain gage is bolted to the top plank of the downstream fencing, in the second panel of the bridge from the right bank. Chain length is 47.33 feet. The gage is read once a day by J. H. Hunt.

The river channel is cut through soft rock, but the bed is sandy and has some moss and other vegetation. The current is moderately slow, becoming sluggish at low water.

The bench mark is the top of the downstream end of the second floor beam from the right bank; elevation, 41 feet above the datum of the gage.

Discharge measurements of Suwanee River at White Springs, Fla., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 16	W. E. Hall	88	397	2.68	154
May 28	do	131	1,860	15.67	5,350

Daily gage height, in feet, of Suwanee River at White Springs, Fla., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	10.8	17.6	15.5	12.5	5.3	3.8	2.9
2	.....	9.8	16.1	15.0	12.9	5.7	3.8	2.9
3	.....	8.7	14.6	14.8	13.0	6.2	3.8	2.9
4	.....	8.1	13.5	14.8	13.3	6.4	3.7	2.9
5	.....	7.8	12.6	14.5	13.0	6.1	3.6	2.9
6	.....	8.0	13.7	15.4	12.7	6.0	3.6	2.9
7	.....	8.8	14.3	15.0	12.1	5.8	3.6	2.9
8	.....	8.7	14.0	14.2	11.8	5.7	3.4	2.8
9	.....	8.5	13.8	13.5	11.1	5.6	3.4	2.8
10	.....	8.3	12.7	12.9	10.9	5.4	3.3	2.8
11	.....	8.5	13.0	12.2	10.5	5.3	3.3	2.8
12	.....	9.2	19.0	11.5	10.1	5.1	3.2	2.8
13	.....	12.1	21.9	11.0	9.5	4.9	3.2	2.8
14	.....	13.0	21.7	10.4	9.3	4.8	3.2	2.8
15	.....	12.9	23.0	10.0	9.0	4.7	3.2	2.8
16	.....	13.5	23.2	10.0	8.7	4.6	3.2	2.8
17	.....	20.1	22.2	10.3	8.0	4.5	3.1	2.8
18	.....	21.1	21.5	10.0	7.8	4.5	3.1	2.8
19	.....	20.5	20.1	9.5	7.4	4.4	3.1	2.8
20	.....	20.1	18.6	9.0	7.1	4.4	3.1	2.8
21	.....	20.2	17.4	8.6	6.7	4.4	3.1	2.8
22	.....	20.3	17.8	8.3	6.4	4.4	3.1	2.8
23	.....	20.5	17.5	8.3	6.1	4.4	3.0	2.7
24	.....	20.5	18.2	9.0	5.8	4.3	3.0	2.7
25	.....	20.4	18.0	9.3	5.7	4.2	3.0	2.7
26	.....	20.1	16.8	9.7	5.6	4.2	3.0	2.7
27	.....	19.6	16.4	9.2	5.5	4.1	3.0	2.7
28	15.6	19.2	15.8	9.5	5.5	4.0	3.0	2.7
29	14.8	18.5	16.3	10.0	5.5	4.0	3.0	2.7
30	13.3	18.0	15.6	11.0	5.3	3.9	2.9	2.7
31	12.0	.....	15.4	11.9	.....	3.9	.....	2.7

MISCELLANEOUS MEASUREMENTS IN SUWANEE RIVER DRAINAGE BASIN.

The following is a list of miscellaneous discharge measurements made in Suwanee River drainage basin during 1906:

Suwanee River near Suwanee, Fla.—A measurement was made May 17, 1906, at a single-span steel truss bridge about 1 mile northeast from Suwanee railroad station. The bench mark is the top of the downstream end of second floor beam from right end of the bridge; elevation, 35 feet above the datum of the assumed gage.

Width, 95 feet; area, 330 square feet; gage height, 2.78 feet; discharge, 317 second-feet.

Suwanee River at Ellaville, Fla.—A measurement was made May 18, 1906, at the Seaboard Air Line Railway bridge, about 300 feet below junction of Withlacoochee and Suwanee rivers. The bench mark is top of upstream end of second floor beam from left end of the bridge; elevation, 41 feet above the datum of the assumed gage.

Width, 250 feet; area, 2,260 square feet; gage height, 5.45 feet; discharge, 4,630 second-feet.

Suwanee Springs near Suwanee, Fla.—A measurement was made May 17, 1906, between the spring outlet and the river, about 200 feet below the wagon bridge.

Width, 5 feet; area, 13 square feet; discharge, 44 second-feet.

Withlacoochee River near Ousley, Ga.—A measurement was made May 22, 1906, at a low wooden wagon bridge 4 miles west of Valdosta,

Ga. The bench mark is top of the downstream end of cap of third bent from the left edge of the river; elevation, 21 feet above the datum of the assumed gage.

Width, 113 feet; area, 233 square feet; gage height, 1.22 feet; discharge, 456 second-feet.

A measurement was made February 20, 1906, at a highway bridge one-half mile west of Ousley. The bench mark is the downstream end of top of third bent from right end of bridge; elevation, 20 feet above the datum of the assumed gage.

Width, 153 feet; area, 1,890 square feet; gage height, 12.10 feet; discharge 6,110 second-feet.

APALACHICOLA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Apalachicola River is formed by the union of Flint and Chattahoochee rivers at the Georgia-Florida line, and flows in a southerly direction through Florida to the Gulf of Mexico. It is navigable, and boats run up Flint River to Albany, Ga., and up Chattahoochee River to Columbus, Ga.

Flint River rises in Fulton County, Ga., a few miles south of Atlanta. It flows in a southerly direction to Talbot County, southeastward to Macon County, southward to Worth County, and southwestward to Apalachicola River. It drains the south-central portion of Georgia, extending from Atlanta south to the Florida line. The tributaries of Flint River are mainly large creeks with much fall. The principal ones among these are Whitewater, Whiteoak, Redoak, Elkins, Big Potato, Muckalee, Kinchafoonee, Ichawaynochaway, and Spring creeks.

Flint River has many good water powers on its course. Between a point opposite Woodbury, Ga., and a point opposite Knoxville, Ga., in Crawford County, a distance of about 45 miles, the river falls 334 feet. Very little of its power is yet developed.

Chattahoochee River rises in the Blue Ridge, in White County, and flows in a southwesterly direction until it reaches the Alabama line at the southeast corner of Troup County, Ga. Thence it flows in a southerly direction, forming the western boundary of Georgia, until it flows into Apalachicola River at the southern boundary of the State. It drains almost all the north-central, middle-western, and southwestern portions of Georgia, and has a drainage area of 4,900 square miles at Columbus, Ga., which is at the fall line.

Soque River joins the Chattahoochee on the western edge of Habersham County. This river rises in Habersham County and flows in a southwesterly direction. It has considerable fall, dropping as much as 40 feet within a few hundred feet.

Farther down the Chattahoochee, at the west boundary of Hall County, Chestatee River enters. It rises in Lumpkin County and

flows in a southerly direction through a very hilly and steep country and has much fall all along its course.

From its source down to Columbus, Ga., Chattahoochee River is an excellent water-power stream. Two of the water-power plants are shown on Pl. III. From the lower edge of Lumpkin County down to Columbus, Ga., there is a fall of over 850 feet, 366 feet of this fall being between West Point and Columbus. All along its course there are many small tributaries flowing from a high, hilly country. These have much fall, and many water powers are available.

CHATTAHOOCHEE RIVER NEAR NORCROSS, GA.

This station was established June 10, 1902. It is located at Medlock's toll bridge, about 4½ miles north of Norcross, Ga., above the mouth of Johns Creek and below the mouth of Sewannee Creek. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 80, and in Water-Supply Paper No. 197, where are given also data for previous years.

Discharge measurements of Chattahoochee River near Norcross, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 9	Hall and Murphy	174	1,240	3.11	2.190
June 11	M. R. Hall	286	1,630	2.53	1.630
July 28	W. E. Hall	173	1,590	3.70	2.870
August 25	M. R. Hall	166	1,450	3.45	2.670
October 27	do	168	1,430	3.60	2.790

Daily gage height, in feet, of Chattahooche River near Norcross, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.75	3.65	2.6	5.1	3.15	2.6	2.45	5.2	6.2	6.2	3.45	3.1
2	2.65	3.5	2.6	4.4	3.05	2.7	2.3	4.3	5.0	7.8	3.4	3.1
3	6.0	3.4	2.9	4.2	3.0	3.1	2.3	4.2	4.3	11.0	3.35	3.1
4	14.6	3.3	4.4	3.95	3.7	2.75	2.8	3.8	4.1	10.4	3.3	3.1
5	12.2	3.25	3.45	3.8	3.3	2.8	2.6	4.4	5.0	7.0	3.3	3.0
6	5.5	3.3	3.05	3.7	3.15	2.85	2.75	3.85	5.8	6.2	3.3	3.0
7	4.4	3.2	2.95	3.7	4.0	2.7	5.0	4.2	4.8	6.6	3.3	3.1
8	4.0	3.15	4.0	3.6	3.6	2.5	3.8	3.75	5.5	5.6	3.3	3.05
9	3.95	3.1	4.0	3.6	3.2	2.5	5.2	3.35	4.8	5.0	3.25	3.0
10	3.7	3.05	3.45	3.9	3.05	2.45	4.0	3.15	6.0	4.8	3.2	3.2
11	3.5	3.0	3.25	3.65	2.9	2.5	3.0	3.1	4.4	4.5	3.2	5.7
12	3.9	3.0	3.0	3.5	2.9	2.65	3.3	3.0	4.8	4.4	3.25	4.4
13	4.2	3.0	3.0	3.4	2.9	5.0	3.4	3.6	4.0	4.2	3.2	3.6
14	3.75	3.0	3.45	3.35	2.8	4.85	3.9	3.45	3.7	4.1	3.15	3.4
15	3.55	2.95	11.5	3.6	2.8	3.9	7.7	5.4	3.5	4.0	3.3	3.3
16	3.8	2.9	11.1	3.85	2.75	3.85	6.6	6.8	3.4	4.0	3.35	3.2
17	3.9	2.8	5.4	3.55	2.7	3.35	4.7	3.9	3.3	3.9	3.3	3.8
18	3.6	2.8	4.3	3.4	2.7	3.05	8.0	7.3	3.7	4.2	3.85	5.4
19	3.5	2.8	9.0	3.3	2.65	2.9	7.6	8.6	7.0	6.0	6.0	4.4
20	3.4	2.8	14.2	3.3	2.65	2.8	5.6	7.8	7.6	4.4	4.9	4.3
21	3.25	2.8	6.8	3.2	2.6	2.65	5.7	6.8	6.0	4.0	4.1	4.2
22	4.5	2.9	5.2	3.2	2.6	2.5	4.7	4.1	5.9	3.95	3.85	3.85
23	9.4	2.85	4.6	3.15	2.6	2.5	5.1	4.1	5.1	3.85	3.65	3.65
24	6.5	2.75	4.2	3.1	2.5	2.5	5.8	3.8	5.8	3.8	3.45	3.45
25	4.8	2.7	4.0	3.1	2.5	3.05	5.0	3.45	4.8	3.75	3.4	3.35
26	4.4	2.7	3.85	3.1	3.0	2.7	3.8	3.4	5.3	3.7	3.3	3.25
27	4.8	2.7	3.9	3.2	4.2	2.6	3.6	3.9	4.4	3.6	3.3	3.2
28	4.8	2.7	4.4	3.6	3.4	2.4	3.75	4.5	4.2	3.55	3.25	3.4
29	4.6	.....	4.2	3.4	2.9	2.5	4.2	5.2	5.1	3.5	3.15	3.85
30	4.1	.....	5.2	3.25	2.75	2.8	4.6	8.2	5.8	3.5	3.1	3.65
31	3.85	.....	7.0	.....	2.65	.....	5.3	10.8	.....	3.5	.....	8.4

A. ATLANTA WATER AND ELECTRIC POWER COMPANY PLANT ON CHATTAHOOCHEE RIVER AT BULL SLUICE, ABOVE ATLANTA, GA.

B. NORTH GEORGIA ELECTRIC POWER COMPANY PLANT ON CHATTAHOOCHEE RIVER NEAR GAINESVILLE, GA.

Rating table for Chattahoochee River near Norcross, Ga., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.30	1,360	3.60	2,780	4.90	4,370	7.40	7,885
2.40	1,460	3.70	2,900	5.00	4,500	7.60	8,185
2.50	1,560	3.80	3,020	5.20	4,760	7.80	8,495
2.60	1,660	3.90	3,140	5.40	5,040	8.00	8,805
2.70	1,770	4.00	3,260	5.60	5,320	9.00	10,440
2.80	1,880	4.10	3,380	5.80	5,600	10.00	12,155
2.90	1,990	4.20	3,500	6.00	5,880	11.00	13,920
3.00	2,100	4.30	3,620	6.20	6,160	12.00	15,760
3.10	2,210	4.40	3,740	6.40	6,440	13.00	17,700
3.20	2,320	4.50	3,860	6.60	6,720	14.00	19,650
3.30	2,430	4.60	3,980	6.80	7,005	15.00	21,600
3.40	2,540	4.70	4,110	7.00	7,295		
3.50	2,660	4.80	4,240	7.20	7,585		

NOTE.—The above table is based on discharge measurements made during 1905-6 and is well defined.

Monthly discharge of Chattahoochee River near Norcross, Ga., for 1906.

[Drainage area, 1,170 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	20,800	1,720	4,660	3.98	4.59
February	2,840	1,770	2,100	1.79	1.86
March	20,000	1,660	4,840	4.14	4.77
April	4,630	2,210	2,750	2.35	2.62
May	3,500	1,560	2,090	1.79	2.06
June	4,500	1,460	2,050	1.75	1.95
July	8,800	1,360	3,940	3.37	3.88
August	13,600	2,100	4,520	3.86	4.45
September	8,180	2,430	4,550	3.89	4.34
October	13,900	2,660	4,670	3.99	4.60
November	5,880	2,210	2,690	2.30	2.57
December	9,440	2,100	3,020	2.58	2.97
The year	20,800	1,360	3,490	2.98	40.66

NOTE.—Values for 1906 are excellent.

CHATTAHOOCHEE RIVER AT WEST POINT, GA.

This station was established July 30, 1896. It is located at the Montgomery street wagon bridge, and is now maintained by the United States Weather Bureau. The conditions at this station and the bench marks [a] are described in Water-Supply Paper No. 168, page 84, and in Water-Supply Paper No. 197, where are given also data for previous years.

Discharge measurements of Chattahoochee River at West Point, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 24	F. A. Murray	458	7,360	12.91	30,100
January 24	do	344	6,880	11.92	27,100
January 25	do	408	5,690	9.20	18,100
January 26	do	399	4,530	6.14	10,300
February 15	E. C. Murphy	390	3,340	3.60	4,390
May 10	M. R. Hall	390	3,540	3.75	4,910
June 9	do	384	3,160	2.78	3,120
November 10	W. E. Hall	386	3,040	3.25	3,720

[a] The reference point is the top of the downstream end of the second iron floor beam under the bridge floor from the right-bank end of the bridge; elevation, 24.19 feet.

Daily gage height, in feet, of Chattahoochee River at West Point, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.7	4.6	3.1	6.4	3.6	3.0	2.5	6.4	7.2	6.3	3.5	3.3
2	3.6	4.4	3.1	6.4	3.5	2.8	3.0	5.1	8.2	6.2	3.45	3.25
3	5.3	4.2	3.5	5.4	3.4	2.7	2.5	4.9	5.9	7.0	3.4	3.25
4	13.1	4.0	4.2	5.0	3.7	2.8	4.0	5.2	4.9	8.5	3.4	3.25
5	12.9	4.0	3.8	4.7	4.1	3.3	3.2	6.0	4.1	9.4	3.35	3.2
6	12.2	3.9	4.1	4.6	4.1	3.2	2.8	6.8	11.2	7.6	3.35	3.25
7	12.6	4.0	3.8	4.4	4.3	2.9	2.6	4.9	9.4	5.6	3.4	3.35
8	5.7	4.0	5.6	4.3	5.5	2.8	3.1	4.1	6.1	5.3	3.3	3.3
9	4.9	3.9	8.1	4.2	4.9	2.8	6.0	4.0	4.3	5.0	3.3	3.25
10	4.6	3.9	6.4	4.5	4.1	2.6	4.3	3.9	4.7	4.4	3.3	3.3
11	4.4	3.7	5.2	4.7	3.7	2.6	4.4	3.6	4.5	4.2	3.25	4.0
12	4.3	3.7	4.5	4.4	3.5	2.6	3.9	4.3	5.7	4.0	3.25	4.4
13	4.4	3.6	4.1	4.3	3.4	4.6	3.5	3.7	4.6	3.9	3.3	5.0
14	4.4	3.6	3.9	4.0	3.3	8.5	3.8	6.2	4.2	3.8	3.3	4.1
15	4.4	3.6	7.6	4.1	3.2	8.6	7.0	8.2	3.8	3.7	3.6	3.7
16	4.2	3.6	11.6	4.1	3.2	6.8	6.8	5.6	3.5	3.7	3.55	3.5
17	4.1	3.5	11.7	4.0	3.1	5.2	7.6	6.1	3.4	3.6	3.6	3.75
18	4.1	3.4	11.0	4.1	3.0	4.6	6.5	5.2	3.3	10.6	4.5	3.8
19	4.2	3.4	11.0	3.9	3.0	3.8	8.5	5.9	3.3	12.3	5.0	5.0
20	4.1	3.4	18.9	3.8	2.95	3.6	8.6	7.5	4.0	7.8	5.1	5.6
21	4.0	3.4	17.6	3.8	2.9	3.4	6.4	6.8	7.4	6.2	5.5	5.1
22	5.4	3.4	15.1	3.8	2.5	3.15	5.1	6.4	6.5	4.7	4.6	4.7
23	11.6	3.4	9.2	3.8	3.0	3.0	5.7	5.0	5.9	4.3	4.1	4.3
24	13.4	3.3	6.0	3.5	2.8	2.8	8.0	4.3	5.3	4.0	3.6	4.1
25	9.8	3.4	5.2	3.6	2.8	2.7	5.5	4.5	5.3	3.95	3.65	3.8
26	6.6	3.4	4.9	3.7	2.8	2.6	5.6	4.0	5.4	3.85	3.5	3.6
27	5.7	3.2	4.8	3.5	3.3	3.1	5.4	3.6	4.3	3.75	3.45	3.6
28	5.4	3.2	7.2	3.1	3.4	3.1	3.9	4.2	4.5	3.55	3.4	3.65
29	5.4	.....	7.6	3.5	3.9	3.0	4.0	4.0	4.5	3.55	3.35	4.0
30	5.3	.....	6.5	3.8	3.4	2.8	4.3	5.4	5.0	3.55	3.3	4.4
31	4.9	.....	6.6	.....	3.1	.....	5.0	6.0	.....	3.5	.....	7.0

Rating table for Chattahoochee River at West Point, Ga., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.50	2,530	3.70	4,680	4.90	7,290	8.00	14,900
2.60	2,680	3.80	4,880	5.00	7,520	9.00	17,740
2.70	2,840	3.90	5,090	5.20	7,980	10.00	20,700
2.80	3,000	4.00	5,300	5.40	8,440	11.00	23,860
2.90	3,170	4.10	5,510	5.60	8,920	12.00	27,100
3.00	3,340	4.20	5,730	5.80	9,400	13.00	30,500
3.10	3,520	4.30	5,950	6.00	9,880	14.00	33,900
3.20	3,700	4.40	6,170	6.20	10,360	15.00	37,350
3.30	3,890	4.50	6,390	6.40	10,840	16.00	40,800
3.40	4,080	4.60	6,610	6.60	11,320	17.00	44,250
3.50	4,280	4.70	6,830	6.80	11,820	18.00	47,700
3.60	4,480	4.80	7,060	7.00	12,320	19.00	51,150

NOTE.—The above table is based on discharge measurements made during 1903-1906 and is well defined.

Monthly discharge of Chattahoochee River at West Point, Ga., for 1906.

[Drainage area, 3,300 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	31,900	4,480	11,700	3.55	4.09
February	6,610	3,700	4,660	1.41	1.47
March	50,800	3,520	14,200	4.30	4.96
April	10,800	3,520	5,880	1.78	1.99
May	8,680	2,530	4,270	1.29	1.49
June	16,600	2,680	4,840	1.47	1.64
July	16,600	2,530	7,660	2.32	2.68
August	15,400	4,480	8,110	2.46	2.84
September	24,500	3,890	8,510	2.59	2.89
October	28,100	4,280	8,840	2.68	3.09
November	8,680	3,800	4,700	1.42	1.58
December	12,300	3,700	5,360	1.62	1.87
The year	50,800	2,530	7,400	2.24	30.59

NOTE.—Values are probably excellent.

SOQUE RIVER NEAR DEMOREST, GA.

This station was established July 16, 1904. It is located at Cannon Bridge, on the road from Cornelia to Acorn, 2½ miles from Demorest and about 4 miles above the mouth of the river. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 86, and in Water-Supply Paper No. 197, where are given also data for previous years.

Discharge measurements of Soque River near Demorest, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 23	W. E. Hall	85	394	4.16	1,080
January 23	do	85	366	3.81	905
June 27	do	84	209	2.08	242
July 27	do	84	285	2.82	488
October 1	do	85	322	3.48	790
October 2	do	88	478	5.33	1,750
October 2	do	88	487	5.37	1,770

Daily gage height, in feet, of Soque River near Demorest, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.1	2.65	2.2	2.75	2.5	2.2	2.05	2.85	4.4	4.4	2.55	2.4
2	2.05	2.55	2.15	2.75	2.5	2.25	2.05	2.7	3.7	5.6	2.5	2.4
3	8.2	2.5	2.25	2.7	3.0	2.3	2.05	3.0	3.0	7.5	2.5	2.4
4	5.8	2.45	2.2	2.65	2.75	2.6	2.0	2.75	6.4	3.8	2.6	2.45
5	3.6	2.4	2.2	2.7	2.5	2.3	2.1	2.7	5.2	2.5	2.6	2.4
6	3.0	2.35	2.25	2.65	2.5	2.3	3.3	2.6	3.5	2.3	2.55	2.45
7	2.4	2.35	2.2	2.65	2.85	2.2	2.45	2.75	3.2	2.35	2.55	2.45
8	2.35	2.3	3.2	2.65	2.5	2.2	3.0	2.7	2.85	3.7	2.55	2.45
9	2.5	2.3	2.5	2.8	2.4	2.2	2.85	2.6	2.8	3.5	2.55	2.5
10	2.4	2.3	2.3	2.75	2.4	2.2	2.7	2.6	4.3	3.1	2.6	2.55
11	3.0	2.25	2.25	2.7	2.4	2.25	2.95	2.65	3.8	2.8	2.6	6.1
12	2.9	2.4	2.2	2.6	2.35	5.0	2.9	2.5	3.9	2.45	2.55	4.3
13	2.7	2.3	2.25	2.55	2.35	3.2	2.65	2.4	3.6	2.35	2.55	3.0
14	2.55	2.25	2.8	2.6	2.3	2.85	2.1	2.35	2.9	2.8	2.5	2.9
15	2.45	2.25	8.1	2.9	2.25	2.8	5.0	4.8	2.85	3.1	2.5	2.85
16	2.65	2.2	3.4	2.8	2.25	2.75	2.8	3.0	2.5	3.15	2.7	2.95
17	2.55	2.2	3.1	2.75	2.2	2.55	2.8	2.8	2.35	3.9	2.65	4.8
18	2.4	2.2	3.7	2.55	2.2	2.4	4.6	[a]13.5	5.8	4.8	2.65	3.6
19	2.3	2.2	8.3	2.5	2.2	2.35	3.2	4.0	5.0	3.8	4.0	3.4
20	2.25	2.2	3.8	2.5	2.25	2.25	2.9	3.4	4.0	3.4	3.8	2.95
21	2.2	2.25	3.2	2.5	2.25	2.2	2.95	2.9	3.2	3.1	3.6	2.9
22	6.7	2.4	3.1	2.45	2.2	2.2	5.5	2.8	6.2	3.0	3.2	2.85
23	5.6	2.2	2.85	2.45	2.2	2.2	4.4	3.2	5.3	2.95	3.0	2.6
24	3.4	2.2	2.7	2.45	2.2	2.5	3.2	2.9	4.0	2.9	2.8	2.6
25	2.8	2.2	2.65	2.4	2.25	2.2	2.95	2.8	3.6	2.85	2.6	2.55
26	2.55	2.2	2.5	2.4	2.45	2.15	2.7	2.7	3.7	2.8	2.55	2.55
27	2.45	2.25	3.2	2.5	3.2	2.1	2.75	2.65	3.8	2.8	2.5	2.7
28	2.95	2.2	3.1	3.0	3.0	2.1	2.9	2.6	3.8	2.75	2.45	2.8
29	2.9	.....	3.2	2.55	2.3	2.8	2.75	8.2	3.3	2.7	2.5	2.75
30	2.7	.....	4.0	2.5	2.35	2.2	2.7	4.9	4.2	2.65	2.45	2.9
31	2.6	.....	2.85	.....	2.25	.....	3.4	6.2	.....	2.6	.....	6.2

[a] Maximum gage height 17.0 feet.

Rating table for Soque River near Demorest, Ga., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	243	3.00	568	4.00	1,000	5.80	2,070
2.10	271	3.10	606	4.20	1,100	6.00	2,220
2.20	300	3.20	645	4.40	1,200	6.20	2,370
2.30	330	3.30	685	4.60	1,310	6.40	2,520
2.40	361	3.40	725	4.80	1,420	6.60	2,680
2.50	393	3.50	770	5.00	1,540	6.80	2,840
2.60	426	3.60	815	5.20	1,665	7.00	3,000
2.70	460	3.70	860	5.40	1,795	8.00	3,880
2.80	495	3.80	905	5.60	1,930	9.00	4,780
2.90	531	3.90	950				

NOTE.—The above table is based on discharge measurements made during 1904-1906 and is well defined below gage height 6 feet. Above gage height 7.4 feet the rating curve is a tangent, the difference being 90 per tenth.

Monthly discharge of Soque River near Demorest, Ga., for 1906.

[Drainage area, 112 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	4,060	257	731	6.53	7.53
February	443	300	332	2.96	3.08
March	4,150	286	729	6.51	7.50
April	568	361	435	3.88	4.33
May	645	300	374	3.34	3.85
June	1,540	271	396	3.54	3.95
July	1,860	243	601	5.37	6.19
August	8,830	346	1,070	9.55	11.01
September	2,520	346	1,010	9.02	10.06
October	3,430	330	751	6.71	7.74
November	1,000	377	477	4.26	4.75
December	2,370	361	643	5.74	6.62
The year	8,830	257	629	5.62	76.61

NOTE.—Values can probably be considered excellent.

FLINT RIVER NEAR WOODBURY, GA.

Measurements of the flow of Flint River were made during 1897 and 1898 at Molina, Ga., but the river bed was so shifting that the station was discontinued June 2, 1898. Measurements were made in 1899 at the Macon and Birmingham Railroad bridge, near Woodbury, Ga., 5 miles below the Molina station. March 29, 1900, a gage was put in near this bridge and the station was reestablished. Gage readings are furnished by the U. S. Weather Bureau. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 90, and in Water-Supply Paper No. 197, where are given also data for previous years.

Discharge measurements of Flint River near Woodbury, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 10	W. E. Hall	273	1,070	1.40	1,440
April 12	F. A. Murray	287	1,080	1.22	1,190
May 29	do	282	894	.52	564
June 18	do	290	1,360	2.13	2,380
September 11	do	283	1,040	1.06	937
November 15	W. E. Hall	253	898	.93	776

Daily gage height, in feet, of Flint River near Woodbury, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.3	1.6	0.8	2.5	0.5	0.3	0.2	1.3	0.9	1.6	0.6	0.7
2	1.3	1.5	.9	2.1	.5	.3	1.0	1.0	.9	2.1	.7	.7
3	1.7	1.4	1.1	1.8	.5	.3	.4	1.0	1.3	2.6	.7	.7
4	4.5	1.2	1.5	1.6	.8	.4	1.5	1.1	.9	2.6	.6	.7
5	4.7	1.2	1.4	1.4	1.2	.6	1.0	3.5	.8	2.2	.6	.6
6	4.9	1.2	1.1	1.3	1.1	.5	.6	3.3	3.6	3.0	.6	.7
7	4.0	1.3	1.0	1.2	1.0	.3	.4	1.9	2.7	2.3	.6	.6
8	2.9	1.4	1.9	1.2	1.4	.2	.5	1.7	1.1	1.6	.6	.7
9	2.0	1.5	3.2	1.2	1.3	.2	1.3	1.7	.8	1.0	.5	.8
10	1.7	1.5	3.2	1.5	1.1	.5	1.5	1.3	1.2	.8	.6	.8
11	1.5	1.4	2.8	1.4	.9	.3	1.0	1.1	1.0	.7	.6	.9
12	1.7	1.2	2.2	1.3	.8	.2	3.6	1.2	1.0	.6	.6	1.0
13	1.8	1.2	1.8	1.1	.6	4.3	2.3	1.2	1.4	.6	.6	1.0
14	1.8	1.2	1.5	1.0	.6	5.9	1.6	2.1	1.3	.5	.5	.9
15	1.7	1.3	2.8	1.3	.5	6.2	1.8	2.9	.8	.5	.9	.9
16	1.5	1.2	3.9	1.2	.5	6.2	1.5	3.5	.6	.5	1.0	.8
17	1.4	1.1	3.9	1.0	.4	4.5	1.2	2.1	.5	.5	.9	.8
18	1.3	1.0	3.5	.9	.4	2.5	1.2	1.0	.4	1.3	1.7	1.1
19	1.3	1.0	3.0	.9	.4	1.7	2.3	1.2	.8	3.8	2.4	1.2
20	1.3	1.0	7.5	.8	.3	1.7	2.1	.8	1.4	3.1	2.0	1.6
21	1.3	1.0	7.8	.8	.4	1.2	1.7	.6	1.4	2.9	1.7	1.7
22	2.7	1.1	7.3	.8	.4	.8	1.1	.8	1.8	1.8	1.3	1.6
23	4.7	1.1	5.2	.7	.4	.7	2.6	1.7	1.6	1.5	1.1	1.3
24	6.3	1.0	2.9	.7	.4	.6	3.1	2.7	1.5	1.2	1.0	1.1
25	5.6	1.0	2.1	.6	.3	.5	2.5	1.2	1.4	1.0	.9	1.0
26	3.7	.9	1.7	.6	.4	.4	1.7	.9	1.5	.9	.8	.9
27	3.0	.9	1.6	.6	.6	.4	1.8	1.1	1.2	.9	.8	.8
28	2.6	.9	2.3	.6	.6	.4	1.7	1.8	1.0	.8	.8	.9
29	2.3	.....	3.1	.5	.5	.3	1.1	1.5	1.0	.7	.7	1.2
30	2.0	.....	3.6	.6	.5	.3	1.7	3.0	.8	.7	.7	1.4
31	1.8	.....	2.9	.....	.4	.....	1.4	1.4	.....	.7	.....	2.2

Rating table for Flint River near Woodbury, Ga., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.00	280	1.10	1,050	2.20	2,220	3.60	4,160
.10	320	1.20	1,140	2.30	2,340	3.80	4,480
.20	370	1.30	1,230	2.40	2,460	4.00	4,800
.30	420	1.40	1,320	2.50	2,590	4.20	5,140
.40	480	1.50	1,420	2.60	2,720	4.40	5,480
.50	540	1.60	1,520	2.70	2,860	4.60	5,820
.60	610	1.70	1,630	2.80	3,000	4.80	6,160
.70	690	1.80	1,740	2.90	3,140	5.00	6,520
.80	780	1.90	1,860	3.00	3,280	6.00	8,450
.90	870	2.00	1,980	3.20	3,560	7.00	10,750
1.00	960	2.10	2,100	3.40	3,850	8.00	13,250

NOTE.—The above table is based on discharge measurements made during 1904–1906, and is fairly well defined below gage height 5 feet.

Monthly discharge of Flint River near Woodbury, Ga., for 1906.

[Drainage area, 990 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft per sq. mile.	Depth in inches.
January	9,100	1,230	2,950	2.98	3.44
February	1,520	870	1,130	1.14	1.19
March	12,800	780	3,520	3.56	4.10
April	2,590	540	1,080	1.09	1.22
May	1,320	420	663	.670	.77
June	8,880	370	1,810	1.83	2.04
July	4,160	370	1,540	1.56	1.80
August	4,000	610	1,690	1.71	1.97
September	4,160	480	1,210	1.22	1.36
October	4,480	540	1,500	1.52	1.75
November	2,460	540	893	.902	1.01
December	2,220	610	978	.988	1.14
The year	12,800	370	1,580	1.60	21.79

NOTE.—Values for 1906 are excellent.

FLINT RIVER NEAR MONTEZUMA, GA.

This station is located at the iron highway bridge about 1 mile west of Montezuma, Ga. Some discharge measurements had already been made at this point when the United States Weather Bureau established a standard chain gage on the bridge, late in 1904. During 1906 the daily gage heights have been furnished by the Weather Bureau. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 92, and in Water-Supply Paper No. 197, where are given also data for previous years.

Discharge measurements of Flint River near Montezuma, Ga., in 1901–1906

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1901.					
July 18	F. A. Murray	173	1,980	4.38	2,400
1904.					
September 21	J. M. Giles	188	1,300	1.85	972
1905.					
August 23	F. A. Murray	198	1,550	3.15	1,610
August 31	do	198	1,390	2.41	1,250
October 12	W. E. Hall	195	1,330	2.25	1,150
1906.					
April 11	W. E. Hall	202	2,200	6.38	3,420
June 16	F. A. Murray	225	3,260	11.92	8,110
November 30	W. E. Hall	196	1,490	3.94	1,960

Daily gage height, in feet, of Flint River near Montezuma, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.5	8.5	4.9	11.8	3.4	2.8	3.0	5.4	8.8	4.5	2.9	3.7
2	6.3	7.6	4.9	10.0	3.4	2.8	3.0	5.6	6.6	4.4	2.9	3.6
3	6.2	7.0	5.1	8.1	3.4	2.7	3.6	5.5	5.4	7.2	2.8	3.6
4	7.4	6.7	5.7	7.0	3.5	2.7	3.5	5.3	5.3	10.0	2.8	3.6
5	10.4	6.3	5.6	6.9	4.0	2.7	3.4	5.0	5.5	11.9	2.8	3.5
6	12.4	6.1	5.5	6.8	4.4	2.9	4.0	4.6	5.1	12.4	2.8	3.5
7	13.0	5.9	5.4	6.6	5.2	3.2	3.8	4.4	5.6	12.0	2.8	3.6
8	13.4	6.0	5.6	6.4	6.0	3.0	3.4	4.1	10.3	10.2	2.7	3.9
9	12.0	6.5	6.7	6.2	6.4	2.9	3.2	8.0	11.4	9.0	2.7	4.0
10	11.4	7.5	8.5	6.4	6.2	2.6	6.3	6.5	11.7	8.0	2.7	4.0
11	10.6	8.0	8.0	6.6	5.6	2.5	6.9	6.0	9.0	6.5	2.9	4.0
12	8.0	7.7	7.6	6.7	4.8	2.5	5.5	6.0	7.0	5.8	3.1	3.8
13	7.0	7.0	7.0	6.6	4.2	3.0	5.0	5.5	6.0	5.0	3.3	3.7
14	6.9	6.5	7.4	6.3	3.8	3.8	8.4	6.0	5.5	4.6	3.5	3.7
15	7.2	6.4	6.6	6.4	3.5	8.8	8.6	5.8	7.5	4.4	3.8	3.7
16	7.0	6.2	6.0	6.6	3.2	10.6	7.6	7.0	5.7	4.2	4.6	3.8
17	6.9	6.0	6.0	6.4	3.1	11.9	6.4	7.8	5.0	4.0	5.0	3.9
18	6.8	5.7	9.0	6.0	3.0	12.6	6.0	7.0	4.8	3.7	5.5	4.2
19	6.8	5.7	9.6	5.6	2.8	13.0	5.9	6.7	4.7	3.6	5.8	4.2
20	6.4	5.7	10.5	5.0	2.7	12.1	6.7	6.0	4.4	7.3	5.6	4.8
21	6.0	5.7	10.8	4.5	2.7	10.0	7.0	5.0	4.0	7.8	6.0	6.2
22	6.1	5.7	12.0	4.2	2.6	8.0	7.2	4.4	5.8	9.7	6.6	7.0
23	11.4	6.6	13.7	4.0	2.5	7.0	6.4	6.0	5.4	7.7	6.0	7.6
24	12.2	6.0	14.4	3.8	2.7	6.1	6.0	6.9	4.6	5.0	5.5	6.5
25	14.2	5.7	13.8	3.6	3.0	5.6	9.3	7.5	4.0	4.0	5.2	5.2
26	15.0	5.4	12.1	3.5	3.1	5.0	10.0	7.2	4.0	3.5	4.6	4.8
27	14.3	5.2	9.0	3.5	3.4	4.4	9.6	6.5	4.0	3.3	4.0	4.6
28	12.0	5.0	7.8	3.5	3.4	3.6	8.4	6.0	4.4	3.2	3.8	4.5
29	11.6	.....	6.8	3.5	3.2	3.4	7.0	5.6	5.0	3.1	3.7	4.6
30	9.8	.....	6.4	3.4	3.0	3.2	6.6	5.4	4.7	3.0	3.7	5.0
31	10.0	.....	8.0	.....	2.9	.....	6.0	8.0	.....	3.0	.....	5.2

Rating table for Flint River near Montezuma, Ga., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	640	2.40	1,215	3.80	1,900	6.40	3,550
1.10	675	2.50	1,260	3.90	1,955	6.60	3,690
1.20	710	2.60	1,305	4.00	2,010	6.80	3,840
1.30	750	2.70	1,350	4.20	2,120	7.00	3,990
1.40	790	2.80	1,400	4.40	2,240	8.00	4,750
1.50	830	2.90	1,450	4.60	2,360	9.00	5,570
1.60	870	3.00	1,500	4.80	3,480	10.00	6,420
1.70	910	3.10	1,550	5.00	2,600	11.00	7,300
1.80	950	3.20	1,600	5.20	2,725	12.00	8,200
1.90	990	3.30	1,650	5.40	2,855	13.00	9,160
2.00	1,035	3.40	1,700	5.60	2,990	14.00	10,200
2.10	1,080	3.50	1,750	5.80	3,130	15.00	11,270
2.20	1,125	3.60	1,800	6.00	3,270	16.00	12,400
2.30	1,170	3.70	1,850	6.20	3,410	17.00	13,530

NOTE.—The above table is based on discharge measurements made during 1901–1906, and is well defined between gage heights 1.8 feet and 6 feet.

Monthly discharge of Flint River near Montezuma, Ga., for 1905–6.

[Drainage area, 2,700 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
January	4,440	1,600	2,230	0.826	0.95
February	13,900	1,600	5,930	2.20	2.29
March	5,230	2,300	3,200	1.19	1.37
April	5,150	1,850	2,480	.918	1.02
May	3,690	1,600	2,470	.915	1.05
June	2,010	1,040	1,350	.500	.56
July	4,360	950	1,770	.656	.76
August	4,910	750	2,250	.833	.96
September	2,360	640	1,140	.422	.47
October	2,060	950	1,280	.474	.55
November	2,420	990	1,430	.530	.59
December	10,100	1,170	4,910	1.82	2.10
The year	13,900	640	2,540	.940	12.67
1906.					
January	11,300	3,270	6,170	2.29	2.64
February	5,150	2,600	3,540	1.31	1.36
March	10,600	2,540	4,970	1.84	2.12
April	8,020	1,700	3,280	1.21	1.35
May	3,550	1,260	1,900	.704	.81
June	9,160	1,260	3,270	1.21	1.35
July	6,420	1,500	3,420	1.27	1.46
August	4,750	2,060	3,310	1.23	1.42
September	7,930	2,010	3,430	1.27	1.42
October	8,580	1,500	3,620	1.34	1.54
November	3,690	1,350	2,070	.767	.86
December	4,440	1,750	2,310	.856	.99
The year	11,300	1,260	3,440	1.27	17.32

NOTE.—Values for 1905 and 1906 are excellent.

FLINT RIVER AT ALBANY, GA.

This station was originally established by the United States Weather Bureau April 10, 1893, and has been maintained from that date to the present. Discharge measurements by the Geological Survey were begun in 1901, and the gage-height records furnished by the Weather Bureau have been used, except for a portion of the

year 1903. The present observer, D. W. Brosnan, is paid by the Weather Bureau. Discharge measurements are made from the bridge of the Georgia Northern Railroad. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 94, and in Water-Supply Paper No. 197, where are given also data for previous years.

Discharge measurements of Flint River at Albany, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 12	W. E. Hall	134	2,960	9.62	13,300
February 13	do	288	3,660	9.06	12,800
April 14	do	122	2,640	4.90	6,910
June 14	F. A. Murray	122	2,400	3.64	5,500
August 13	W. E. Hall	118	2,490	3.35	4,720
November 28	do	115	2,350	2.33	3,900

Daily gage-height, in feet, of Flint River at Albany, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.9	14.1	4.6	7.9	1.8	2.7	2.0	5.8	5.1	2.8	2.2	1.9
2	7.3	11.6	4.3	9.1	1.8	2.4	1.9	5.4	5.0	2.7	2.0	1.8
3	6.9	9.0	5.1	10.4	1.7	1.9	2.1	5.0	6.1	2.7	2.0	1.8
4	7.9	7.5	6.4	10.2	1.7	1.8	2.5	4.9	5.0	3.7	1.9	1.7
5	8.6	6.5	7.2	8.8	3.1	1.7	2.5	4.6	4.2	5.8	1.8	1.7
6	10.2	6.1	8.0	7.1	4.2	1.6	2.8	3.8	4.0	6.9	1.8	1.7
7	10.5	5.8	7.9	6.0	5.1	1.9	2.8	3.2	4.0	8.5	1.8	1.8
8	11.1	6.2	7.7	5.3	6.4	2.1	2.7	4.2	5.3	9.3	1.8	1.9
9	12.0	6.8	7.7	4.9	7.2	1.8	2.8	5.1	7.6	9.7	1.8	2.0
10	12.7	7.3	7.9	4.6	7.1	1.2	2.9	5.6	9.7	9.0	1.7	2.0
11	12.9	9.2	8.5	4.5	6.3	1.5	5.0	5.8	10.2	7.7	1.7	2.1
12	12.5	9.7	8.9	4.5	5.5	1.4	5.6	4.8	9.9	6.5	1.6	2.0
13	11.2	9.3	9.1	4.8	4.6	2.0	5.8	3.6	7.8	4.2	1.6	2.0
14	8.8	8.9	9.2	4.9	3.8	3.3	6.5	3.4	6.0	2.5	1.5	2.0
15	7.9	7.9	8.8	4.7	3.1	4.9	7.6	3.6	4.5	2.2	1.8	2.2
16	7.6	7.0	8.1	4.5	2.6	7.3	7.9	3.5	4.5	2.0	2.0	2.1
17	7.1	6.6	6.7	4.5	2.3	9.5	8.1	4.0	4.4	2.0	2.1	2.0
18	6.7	6.4	6.2	4.4	2.3	10.4	8.3	5.3	4.3	2.1	3.0	1.8
19	6.3	6.0	6.2	4.3	2.2	10.4	8.4	5.5	3.5	2.1	3.5	1.8
20	6.0	5.5	8.0	3.9	2.2	10.6	7.7	5.7	2.6	2.0	3.1	2.2
21	5.8	5.2	9.0	3.5	2.1	11.1	7.4	5.9	2.0	3.4	2.9	3.0
22	6.2	5.6	10.4	3.3	2.2	11.4	7.3	5.3	1.7	4.8	3.5	3.6
23	8.1	5.9	10.8	3.2	2.5	10.4	7.0	4.3	2.3	6.7	4.3	4.5
24	13.2	6.4	11.2	2.9	2.6	8.0	6.4	4.1	3.6	7.1	4.0	5.0
25	17.0	6.3	12.1	2.6	2.6	5.2	5.7	5.3	3.7	6.7	3.6	5.0
26	17.5	6.0	13.1	2.5	2.8	3.5	6.2	6.1	3.4	5.5	3.3	4.2
27	18.1	5.5	13.7	2.4	3.7	2.8	7.0	6.2	3.1	3.7	2.6	3.5
28	18.0	5.0	13.6	2.3	4.2	2.5	7.4	5.5	3.1	3.2	2.4	3.0
29	17.1	.....	12.2	2.1	4.5	2.4	7.8	5.3	3.0	2.8	2.2	2.8
30	16.8	.....	9.0	1.9	4.0	2.6	7.2	5.0	3.0	2.5	2.1	2.8
31	15.9	.....	8.0	.....	3.4	.....	6.2	4.6	.....	2.4	.....	3.3

Rating table for Flint River at Albany, Ga., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	2,960	2.60	4,300	4.00	5,785	6.80	9,170
1.30	3,050	2.70	4,400	4.20	6,015	7.00	9,420
1.40	3,140	2.80	4,500	4.40	6,245	8.00	10,670
1.50	3,235	2.90	4,600	4.60	6,475	9.00	11,920
1.60	3,330	3.00	4,700	4.80	6,705	10.00	13,170
1.70	3,425	3.10	4,805	5.00	6,940	11.00	14,420
1.80	3,520	3.20	4,910	5.20	7,180	12.00	15,750
1.90	3,615	3.30	5,015	5.40	7,420	13.00	17,150
2.00	3,710	3.40	5,120	5.60	7,670	14.00	18,630
2.10	3,805	3.50	5,230	5.80	7,920	15.00	20,140
2.20	3,900	3.60	5,340	6.00	8,170	16.00	21,700
2.30	4,000	3.70	5,450	6.20	8,420	17.00	23,300
2.40	4,100	3.80	5,560	6.40	8,670	18.00	24,900
2.50	4,200	3.90	5,670	6.60	8,920		

NOTE.—The above table is based on eighteen discharge measurements made during 1904–1906 and earlier high-water measurements. It is well defined.

Monthly discharge of Flint River at Albany, Ga., for 1906.

[Drainage area, 5,000 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	25,100	7,920	14,600	2.92	3.37
February	18,800	6,940	9,760	1.95	2.03
March	18,200	6,130	11,600	2.32	2.68
April	13,700	3,620	6,900	1.38	1.54
May	9,670	3,420	5,370	1.07	1.23
June	14,900	2,960	6,840	1.37	1.53
July	11,200	3,620	7,720	1.54	1.78
August	8,420	4,910	6,790	1.36	1.57
September	13,400	3,420	6,800	1.36	1.52
October	12,800	3,710	6,660	1.33	1.53
November	6,130	3,240	4,110	.822	.92
December	6,940	3,420	4,310	.862	.99
The year	25,100	2,960	7,620	1.52	20.69

NOTE.—Values for 1906 are excellent.

KINCHAFOONEE CREEK NEAR LEESBURG, GA.

This station was established August 30, 1905. It is located at the iron highway bridge 1 mile east of Leesburg, Ga.

A standard chain gage was installed May 12, 1906, and set to read the same as the old vertical gage. It is attached to the downstream lower chord. The bottom of the box is 24.09 feet above the zero of the gage, and the length of the chain is 26.09 feet. The gage is read by H. B. Johnson. The bench mark is a cross on a bowlder embedded in the earth opposite the left end of the bridge approach and 25 feet upstream; elevation, 23.09 feet above gage datum. The conditions at this station are described in Water-Supply Paper No. 168, page 98, and in Water-Supply Paper No. 197, where are given also data for previous years.

Discharge measurements of Kinchafoonee Creek near Leesburg, Ga., in 1905–1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
August 30	F. A. Murray	90	180	0.98	[illegible]
October 13	W. E. Hall	90	238	1.70	[illegible]
1906.					
February 14	W. E. Hall	130	759	6.67	1,[illegible]
April 13	do	115	438	3.87	[illegible]
June 15	F. A. Murray	152	888	6.94	1,730
November 29	W. E. Hall	105	333	2.44	46[illegible]
1907.					
January 19	M. R. Hall	107	342	2.72	5[illegible]

Daily gage height, in feet, of Kinchafoonee Creek near Leesburg, Ga., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.0	2.3	2.5	3.8	3.5	2.8	2.5	2.4
2		2.0	2.1	2.4	3.6	3.3	3.4	2.5	[illegible]
3		1.9	1.9	2.5	3.5	3.1	4.1	2.5	[illegible]
4		2.0	1.8	2.7	3.1	2.9	5.2	2.7	2.3
5		3.6	2.0	2.9	2.7	2.8	5.0	2.9	2.3
6		5.0	2.3	3.0	2.5	3.4	5.1	2.7	2.2
7		5.5	2.5	2.9	2.7	5.6	5.2	2.5	2.3
8		6.0	2.1	2.8	2.9	7.7	5.3	2.3	2.3
9		6.5	1.4	3.0	3.3	10.5	4.9	2.3	2.3
10		5.9	1.1	3.6	2.3	9.7	4.5	2.2	2.3
11		4.8	1.0	4.5	2.0	7.1	3.9	2.2	2.3
12	3.8	4.6	2.3	5.9	2.1	4.4	3.0	2.2	2.4
13	3.8	3.7	4.1	7.1	2.2	3.8	2.3	2.1	2.5
14	3.8	2.9	5.6	8.2	2.3	3.1	2.1	2.0	[illegible]
15	3.7	2.7	7.2	6.8	2.5	2.9	2.0	2.5	2.5
16	3.8	2.5	11.5	5.1	2.6	2.7	1.9	2.9	2.4
17	3.9	2.3	10.0	5.2	2.6	2.5	1.8	3.1	2.4
18	3.8	2.2	8.6	5.8	2.5	2.3	1.9	3.3	2.5
19	3.4	2.5	7.8	5.3	2.2	2.2	2.6	3.4	3.0
20	2.9	2.4	7.2	4.9	1.9	2.1	3.5	3.5	3.6
21	2.7	2.3	7.1	4.7	1.7	2.0	4.7	3.5	4.2
22	2.6	2.2	7.3	4.9	1.7	1.8	6.3	3.3	4.8
23	2.5	2.1	5.5	5.1	2.8	1.9	7.8	3.1	5.0
24	2.5	2.2	4.6	4.3	3.1	2.0	6.5	2.8	4.5
25	2.3	2.7	3.7	3.9	3.5	1.8	4.9	2.7	3.9
26	2.2	3.4	3.3	3.6	3.4	1.6	3.4	2.6	3.2
27	2.1	3.9	2.9	3.1	3.3	1.8	2.9	2.5	2.9
28	2.1	4.5	2.8	3.0	3.4	2.0	2.8	2.5	2.7
29	2.1	4.3	2.7	3.6	3.5	2.1	2.7	2.4	2.8
30	2.0	3.6	2.6	4.5	3.7	2.3	2.7	2.4	3.0
31		2.5		4.1	3.6		2.6		3.3

Rating table for Kinchafoonee Creek near Leesburg, Ga., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.60	164	2.00	380	3.40	638	5.60	1,189
.70	177	2.10	397	3.50	658	5.80	1,251
.80	191	2.20	414	3.60	679	6.00	1,315
.90	205	2.30	432	3.70	700	6.20	1,381
1.00	220	2.40	450	3.80	721	6.40	1,447
1.10	235	2.50	468	3.90	743	6.60	1,515
1.20	250	2.60	486	4.00	765	6.80	1,583
1.30	266	2.70	504	4.20	811	7.00	1,653
1.40	282	2.80	522	4.40	859	8.00	2,015
1.50	298	2.90	541	4.60	909	9.00	2,400
1.60	314	3.00	560	4.80	961	10.00	2,800
1.70	330	3.10	579	5.00	1,015	11.00	3,200
1.80	346	3.20	598	5.20	1,071		
1.90	363	3.30	618	5.40	1,129		

NOTE.—The above table is based on seven discharge measurements made during 1905–1907 and is well defined below gage height 4 feet.

Monthly discharge of Kinchafoonee Creek near Leesburg, Ga., for 1905–6.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1905.			
September	298	164	211
October	560	250	328
November	522	250	311
1906.			
April (12–30)	743	380	556
May	1,480	363	668
June	3,400	220	969
July	2,090	450	870
August	721	330	528
September	3,000	314	754
October	1,940	346	768
November	658	380	500
December	1,020	414	548

NOTE.—Values for 1905 and 1906 are excellent.

ICHAWAYNOCHAWAY CREEK AT MILFORD, GA.

This station is located at the wagon bridge at Milford, Ga. When first established, on August 29, 1905, the bridge was an old wooden structure, which was shortly afterwards replaced by a new steel bridge, with one span of 110 feet, with short trestle approaches at both ends. The temporary vertical gage was also replaced by a standard chain gage, attached to the downstream side of the new bridge; length of chain, 23.46 feet. The observer is W. J. Kidd.

The current is moderately swift and is broken by old bridge timbers still remaining in the channel. The station is about 100 feet above the remains of an old wooden dam, which retains the water at a higher level than it would otherwise have. Gage heights for 1905 and 1906 are from the chain gage described above, but future records will be from a gage located below the dam.

Discharge measurements of Ichawaynochaway Creek at Milford, Ga., in 1905–1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 29	F. A. Murray	111	458	2.89	364
October 16	W. E. Hall	116	452	3.05	386
1906.					
February 15	W. E. Hall	137	666	4.65	1,390
April 18	do	123	574	3.78	715
April 18	do	123	574	3.76	693
June 13	F. A. Murray	144	718	4.80	1,770
August 14	W. E. Hall	12	555	3.45	726
November 26	do	125	493	3.46	592
1907.					
January 22	M. R. Hall	120	496	3.56	690
January 22	do	120	499	3.57	705

Daily gage height, in feet, of Ichawaynochaway Creek at Milford, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.4	4.9	4.1	4.3	3.1	3.7	3.9	3.4	4.4	3.5	3.2	4.3
2	4.4	4.8	4.05	4.2	3.1	3.6	3.8	3.35	4.1	3.7	3.25	4.3
3	4.6	4.7	4.0	4.1	3.3	3.5	3.7	3.3	4.1	4.0	3.25	4.2
4	5.0	4.6	4.0	4.05	3.5	3.4	3.6	3.3	4.2	4.4	3.25	4.1
5	5.6	4.5	4.2	4.0	4.0	3.3	3.5	3.2	4.3	4.8	3.3	4.0
6	6.0	4.5	4.8	3.9	4.8	3.2	3.5	3.2	4.2	4.7	3.3	3.9
7	5.8	4.6	5.4	3.8	5.3	3.25	3.6	3.3	4.0	4.3	3.3	3.8
8	5.2	4.7	5.0	3.9	5.8	3.3	3.8	3.3	4.1	4.0	3.3	3.7
9	4.8	5.0	4.6	4.0	6.3	3.3	4.0	3.2	4.2	3.7	3.3	3.6
10	4.7	5.3	4.5	4.05	5.6	3.35	4.1	3.2	4.3	3.5	3.3	3.5
11	4.6	5.5	4.4	4.1	5.3	3.4	4.4	3.3	4.05	3.4	3.3	3.4
12	4.45	5.2	4.3	4.0	4.6	3.45	4.8	3.4	3.9	3.3	3.3	3.4
13	4.3	5.0	4.35	3.9	4.1	4.5	5.2	3.35	3.7	3.2	3.35	3.4
14	4.2	4.9	4.4	3.8	3.7	10.9	5.0	3.35	3.5	3.1	3.4	3.4
15	4.0	4.8	4.45	3.8	3.55	11.6	4.6	3.4	3.4	3.0	3.4	3.5
16	4.0	4.7	4.35	3.8	3.4	11.5	4.4	3.45	3.3	2.9	3.4	3.6
17	4.0	4.6	4.3	3.85	3.3	8.6	4.4	3.5	3.3	3.2	4.5	3.7
18	3.9	4.5	4.35	3.8	3.2	6.7	6.2	3.45	3.25	3.6	4.55	3.8
19	3.9	4.4	4.4	3.7	3.1	5.1	5.8	3.45	3.2	3.7	4.5	3.9
20	4.0	4.35	4.4	3.65	3.1	4.7	5.2	3.5	3.1	3.8	4.55	4.0
21	4.1	4.35	4.45	3.6	3.2	4.6	4.6	3.6	3.1	3.8	4.6	4.1
22	4.8	4.4	4.45	3.55	3.3	4.5	4.2	3.7	3.0	3.7	4.7	4.25
23	6.8	4.45	4.45	3.5	3.4	4.35	4.0	3.8	3.0	3.3	4.6	4.4
24	10.3	4.45	4.5	3.45	3.7	4.3	3.9	4.1	2.9	3.2	4.5	4.6
25	10.9	4.4	4.5	3.4	4.1	4.1	3.8	4.5	2.9	3.0	4.4	4.7
26	8.0	4.3	4.5	3.35	4.4	3.9	3.7	4.3	3.0	3.1	4.4	4.6
27	6.5	4.2	4.45	3.3	4.5	3.65	3.6	4.2	3.2	3.2	4.35	4.5
28	6.0	4.15	4.45	3.25	4.55	3.5	3.6	4.0	3.35	3.2	4.3	4.3
29	5.5	.....	4.4	3.2	4.6	3.4	3.55	3.85	3.5	3.3	4.3	4.2
30	5.3	.....	4.35	3.15	4.4	3.6	3.5	3.6	3.5	3.3	4.3	4.1
31	5.1	.....	4.3	.....	3.9	.....	3.4	3.9	.....	3.2	.....	4.1

Rating table for Ichawaynochaway Creek at Milford, Ga., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	170	3.30	540	4.20	1,120	6.00	2,800
2.50	200	3.40	595	4.30	1,200	7.00	3,800
2.60	235	3.50	650	4.40	1,280	8.00	4,800
2.70	270	3.60	710	4.50	1,360	9.00	5,800
2.80	310	3.70	770	4.60	1,445	10.00	6,800
2.90	350	3.80	835	4.70	1,530	11.00	7,800
3.00	395	3.90	900	4.80	1,620		
3.10	440	4.00	970	4.90	1,710		
3.20	490	4.10	1,045	5.00	1,800		

NOTE.—The above table is based on ten discharge measurements made during 1905–1907 and is not well defined.

Monthly discharge of Ichawaynochaway Creek at Milford, Ga., for 1905–6.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1905.			
September	395	185	270
October	770	395	539
November	710	395	516
December	2,800	350	1,130
1906.			
January	7,700	900	2,190
February	2,300	1,080	1,500
March	2,200	970	1,310
April	1,200	465	814
May	3,100	440	1,110
June	8,400	490	1,840
July	3,000	595	1,150
August	1,360	490	703
September	1,280	350	742
October	1,620	350	711
November	1,530	490	913
December	1,530	595	976
The year	8,400	350	1,160

NOTE.—Values for 1905 and 1906 good.

MISCELLANEOUS MEASUREMENTS IN APALACHICOLA RIVER DRAINAGE BASIN.

The following is a list of miscellaneous discharge measurements made in Apalachicola River drainage basin during 1906:

Chattahoochee River near Vinings, Ga.—Measurements were made at a new iron highway bridge 1 mile east of Vinings, Ga., and about 10 miles northwest of Atlanta, Ga. It is about 10 miles below the developed power at Bull Sluice. The bench mark is the top of the upstream end of the second floor beam from the left bank; elevation, 31 feet above the datum of the assumed gage.

June 8: Width, 258 feet; area, 1,140 square feet; gage height, 4.72 feet; discharge, 2,080 second-feet.

August 8: Width, 259 feet; area, 1,280 square feet; gage height, 5.72 feet; discharge, 3,620 second-feet.

Red Oak Creek near Woodbury, Ga.—This stream enters Flint River from the right, 5 miles above the regular gaging station, on Flint River near Woodbury, Ga. A measurement was made May 29, 1906, at a wooden wagon bridge about 1 mile above the mouth of the creek. The bench mark is the top of the first post from the right bank edge, downstream side, 15 feet from a large white oak tree; elevation 20 feet above the datum of the assumed gage.

Width, 62 feet; area, 157 square feet; gage height, 3.31 feet; discharge, 75 second-feet.

Big Potato Creek near Thomaston, Ga.—A measurement was made May 30, 1906, at a covered wagon bridge 2½ miles west of Thomaston, Ga. The bench mark is the top of the downstream lower stringer,

at a point 80 feet from the left end of the bridge; elevation 15 feet above the datum of the assumed gage.

Width, 81 feet; area, 182 square feet; gage height, 3.07 feet; discharge, 97 second-feet.

Another measurement was made May 30, 1906, at the highway bridge about 5 miles southwest of Thomaston, Ga., 200 yards above Daniel's old gristmill. The bench mark is a chisel mark on the intermediate post at the downstream end of the second floor beam; elevation, 28 feet above the datum of the assumed gage.

Width, 84 feet; area, 144 square feet; gage height, 2.07feet; discharge, 101 second-feet.

Muckalee Creek near Leesburg, Ga.—A measurement was made June 15, 1906, about 3 miles east of Leesburg, Ga., at a wooden highway bridge consisting of two truss spans, with trestle approaches about 50 feet each. The bench mark is the top of the upstream end of the wooden cap of the middle bent of the bridge; elevation, 17 feet above the datum of the assumed gage.

Width, 83 feet; area, 624 square feet; gage height, 7.02; discharge, 1,160 second-feet.

Spring Creek near Bainsbridge, Ga.—A measurement was made February 16, 1906, at a steel wagon bridge on the road to Fairchilds, Ga. The bench mark is the top of the downstream end of the second floor beam from the right-bank pier; elevation, 20 feet above the datum of the assumed gage.

Width, 169 feet; area, 1,040 square feet; gage height, 8.45 feet; discharge, 2,110 second-feet.

CHOCTAWHATCHEE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Choctawhatchee River drains the southeastern part of Alabama and that portion of Florida lying immediately south. The main river rises in Barbour County, Ala., a short distance west of Eufaula, Ala., and flows in a southwesterly and southerly direction through Choctawhatchee Bay to the Gulf of Mexico. Pea River is the principal tributary and enters from the west at Geneva, Ala. This branch is the longer of the two above the junction, having its head in Bullock County, near Union Springs, Ala. Double Bridges Creek is an important but small tributary lying between the main branches and entering Choctawhatchee River just above the mouth of Pea River. These are all moderately swift streams, even at low water, and at places the fall is sufficient to make considerable shoals or rapids and offer practicable sites for waterpower developments.

CHOCTAWHATCHEE RIVER NEAR NEWTON, ALA.

This station was established in June, 1906, and is located at the steel highway bridge about 1 mile north of Newton and the same dis-

tance from Elba Junction. Gage-height records have been maintained for a portion of the time only, as it has been difficult to keep an observer. The current is swift and the main portion of the section is deep, it having been excavated for boating. Both banks are high and not liable to overflow.

A standard chain gage is attached to the downstream side of the bridge; length of chain, 45.76 feet. The reference point is the top of the ½-inch rod, the top rod of the bridge fencing on the downstream side, at the third intermediate post from the left end of the bridge; elevation, 45 feet.

Discharge measurements of Choctawhatchee River near Newton, Ala., in 1906–7.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 21	W. E. Hall	115	291	4.40	1,260
June 11	F. A. Murray	96	574	3.08	416
August 15	W. E. Hall	111	259	3.98	867
September 20	F. A. Murray	98	106	2.71	312
1907					
January 23	M. R. Hall	113	198	3.76	747

Daily gage height, in feet, of Choctawhatchee River near Newton, Ala., for 1906.

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1	.....	3.6	3.3	2.8	4.5	17	4.4	4.5	3.1	2.5	.....
2	.....	4.5	3.1	2.8	5.0	18	4.1	4.5	3.2	2.5	.....
3	.....	3.4	2.9	2.8	5.1	19	3.8	4.5	2.8	2.7	.....
4	.....	3.2	2.7	2.8	5.1	20	3.2	4.3	2.5	2.9	.....
5	.....	3.2	.....	2.3	4.3	21	3.1	3.6	2.5	3.3	.....
6	.....	3.2	.....	2.3	5.0	22	2.85	3.5	2.5	3.9	.....
7	.....	3.1	.....	3.0	5.0	23	2.8	3.2	2.8	3.5	.....
8	.....	2.7	.....	3.8	4.9	24	2.7	3.3	3.0	3.0	.....
9	.....	3.2	.....	4.1	4.7	25	2.7	3.5	3.9	3.0	.....
10	.....	3.3	.....	4.3	4.3	26	2.7	3.8	3.3	3.0	.....
11	3.1	3.7	.....	5.0	4.0	27	3.1	4.3	3.1	3.0	.....
12	3.3	4.6	2.7	4.3	4.0	28	3.1	4.5	3.1	4.1	.....
13	3.4	4.9	2.7	4.1	3.9	29	3.0	4.5	2.8	4.8	.....
14	3.5	4.5	3.3	3.1	.....	30	3.2	3.7	2.8	4.7	.....
15	4.2	4.5	3.5	3.0	.....	31	.....	3.5	2.8	.....	.....
16	4.5	4.5	3.9	2.5	.....						

Rating table for Choctawhatchee River near Newton, Ala., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.50	270	3.20	455	3.90	830	4.00	1,485
2.60	290	3.30	495	4.00	900	4.70	1,610
2.70	310	3.40	540	4.10	975	4.80	1,740
2.80	335	3.50	590	4.20	1,060	4.90	1,880
2.90	360	3.60	645	4.30	1,155	5.00	2,020
3.00	390	3.70	705	4.40	1,255		
3.10	420	3.80	765	4.50	1,365		

NOTE.—The above table is based on five discharge measurements made during 1906–7, and is well defined.

PEA RIVER AT ELBA, ALA.

This station, located at the railroad bridge of the Atlantic Coast Line, was established on June 8, 1906. The bridge is in the town, about 800 feet from the station. Measurements are made from the downstream side of the bridge and its trestle approaches. The current is moderately swift, and the bed is rocky and rough.

The standard chain gage is attached to the downstream guard rail; length of chain, 52.21 feet. Gage readings are furnished by the Pea River Power Company. The bench mark is the top of the downstream end of the second floor beam from the right bank; elevation, 48.47 feet above gage datum.

Discharge measurements of Pea River at Elba, Ala., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 21	W. E. Hall	125	438	4.10	1,630
September 15	F. A. Murray	116	191	3.20	325
September 17	do	116	172	3.10	261
September 18	do	115	169	3.10	297

Daily gage height, in feet, of Pea River at Elba, Ala., for 1906.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		4.1	3.55	3.3	8.4	3.6	4.1
2		3.65	3.4	3.3	7.5	3.6	4.0
3		4.5	3.4	3.2	7.9	3.5	4.1
4		3.85	3.85	3.1	6.2	3.5	4.1
5		3.55	3.55	3.1	5.5	3.5	4.0
6		3.3	3.55	3.55	6.1	3.5	4.0
7		3.2	3.65	3.55	6.8	3.5	4.0
8	3.55	3.2	3.4	3.55	5.4	3.5	3.9
9	3.4	3.65	3.3	4.3	4.8	3.5	3.9
10	3.55	6.6	3.3	3.55	4.7	3.5	4.0
11	3.75	4.6	4.2	3.55	4.4	3.4	4.4
12	3.75	5.6	6.6	3.4	4.2	3.6	4.32
13	3.65	6.6	5.0	3.3	4.2	3.55	4.2
14	3.95	6.6	5.2	3.2	4.0	4.6	4.1
15	4.3	7.6	5.5	3.2	3.8	4.3	4.0
16	3.95	6.6	4.7	3.1	3.7	4.0	4.1
17	5.3	7.6	4.3	3.0	3.6	4.1	4.5
18	4.5	5.6	3.95	3.0	3.7	[b] 7.0	4.9
19	3.95	5.1	3.85	2.9	3.9	[b] 10.0	4.7
20	3.85	5.1	3.65	2.9	4.0	5.9	5.3
21	3.65	5.0	3.4	3.1	4.1	6.0	5.0
22	3.4	4.9	3.55	3.3	4.4	6.0	4.8
23	3.2	4.5	3.4	3.3	4.3	5.6	4.7
24	3.2	4.4	3.4	3.2	4.2	5.4	4.5
25	3.1	4.1	3.3	3.2	4.1	5.3	4.4
26	3.3	3.75	3.3	3.2	4.0	5.0	4.3
27	3.2	4.5	3.4	3.3	3.8	4.8	4.2
28	3.2	4.2	3.4	6.6	3.8	4.4	4.2
29	3.1	4.1	3.2	9.6	3.7	4.3	4.5
30	3.1	4.1	3.1	(a)	3.6	4.1	4.8
31		3.75	3.1		3.6		11.8

[a] Water over gage.
[b] Gage heights estimated from records at Pera.

PEA RIVER AT PERA, ALA.

This station was established August 27, 1904. It is located at the Elton wagon bridge, about one-half mile west of Pera, Ala., a station on the Georgiana and Graceville branch of the Louisville and Nashville Railroad. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 103, where are given also references to publications that contain data for previous years.

Discharge measurements of Pea River at Pera, Ala., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 22	W. E. Hall	90	768	8.01	1.810
June 7	F. A. Murray	74	393	3.52	474
September 14	do	75	306	3.38	480
September 14	do	75	306	3.42	488
September 14	do	75	300	3.38	465

Daily gage height, in feet, of Pea River at Pera, Ala., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	10.1	9.1	7.3	7.7	3.9	4.5	3.9	4.5	3.2	17.4	4.0	5.1
2	9.4	8.7	7.0	8.0	3.7	4.3	5.0	4.2	3.5	15.1	4.0	5.1
3	9.4	8.4	14.0	8.5	3.6	4.6	5.3	4.0	3.6	12.9	3.9	4.9
4	15.8	7.9	16.0	7.8	4.3	4.2	4.0	3.9	3.3	13.5	3.8	4.9
5	14.8	7.6	15.1	7.1	7.0	3.8	5.4	3.7	3.1	10.1	3.8	4.8
6	12.0	7.5	13.1	6.6	10.4	3.6	4.4	4.2	3.1	10.1	3.7	4.8
7	11.1	7.3	11.9	6.2	7.2	3.4	3.8	4.5	3.8	11.2	3.7	4.8
8	10.8	8.5	15.1	6.0	14.2	3.3	3.4	4.4	3.8	9.2	3.7	4.6
9	11.3	12.3	17.8	5.8	12.8	3.3	3.3	4.1	4.7	8.0	3.6	4.5
10	10.9	11.6	15.4	5.8	9.5	4.2	5.0	3.5	5.4	7.1	3.7	4.5
11	9.4	10.5	13.3	5.9	8.4	4.3	10.0	3.4	4.4	6.4	3.6	5.7
12	10.0	9.7	12.4	5.7	7.7	4.2	8.8	7.9	4.1	6.0	3.8	5.9
13	10.7	9.2	12.3	5.7	7.1	4.8	10.2	9.1	3.6	5.6	3.6	5.2
14	9.7	9.4	11.4	5.9	6.1	4.5	12.6	7.2	3.4	5.3	3.6	5.0
15	9.2	9.7	11.0	7.5	5.7	6.9	14.1	8.9	3.3	5.0	3.7	4.8
16	8.8	9.1	10.7	7.4	5.0	6.0	15.0	7.5	3.1	4.7	5.2	4.6
17	8.4	8.3	9.3	6.6	4.8	5.2	15.6	7.1	2.8	4.6	4.8	4.8
18	8.0	7.8	8.6	6.2	4.8	8.7	14.3	5.4	2.8	4.4	8.4	6.9
19	7.9	7.4	8.2	5.7	4.6	6.2	11.2	4.7	2.7	4.8	12.2	6.6
20	7.8	7.4	10.0	5.5	4.4	5.8	9.8	4.3	2.6	4.9	11.0	7.6
21	7.5	7.5	9.8	5.4	4.3	5.4	10.5	4.1	3.0	4.9	10.4	7.8
22	9.5	8.2	9.0	5.1	8.8	4.2	9.3	4.0	3.3	5.0	9.3	6.8
23	16.7	7.7	8.4	4.9	5.0	3.7	7.0	3.8	3.3	5.6	8.4	6.4
24	17.0	7.3	8.4	4.7	4.5	3.5	6.5	3.8	3.1	5.6	8.0	6.0
25	17.5	7.6	9.2	4.4	5.4	3.4	6.4	3.6	3.3	5.3	7.6	5.8
26	19.5	7.7	8.8	4.1	7.6	3.3	5.7	3.5	3.1	5.0	7.3	5.4
27	18.8	7.2	8.3	3.9	7.3	3.3	7.4	3.2	4.5	4.6	6.9	5.4
28	14.6	7.0	7.7	4.1	7.0	3.0	6.0	3.1	13.9	4.4	6.2	5.2
29	11.6	.....	7.2	4.0	6.4	3.6	5.4	3.4	20.7	4.3	5.6	5.2
30	10.3	.....	7.9	4.0	5.5	3.1	5.6	3.1	19.2	4.2	5.3	5.1
31	9.5	.....	7.9	.....	4.9	.....	5.4	3.0	.....	4.1	.....	12.8

Rating table for Pea River at Pera, Ala., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.60	342	3.60	528	4.60	754	6.20	1,245
2.70	360	3.70	548	4.70	780	6.40	1,315
2.80	378	3.80	568	4.80	806	6.60	1,385
2.90	396	3.90	590	4.90	834	6.80	1,460
3.00	414	4.00	612	5.00	862	7.00	1,540
3.10	432	4.10	634	5.20	920	8.00	1,940
3.20	450	4.20	656	5.40	980	9.00	2,400
3.30	468	4.30	680	5.60	1,040	10.00	2,900
3.40	488	4.40	704	5.80	1,105		
3.50	508	4.50	728	6.00	1,175		

NOTE.—The above table is based on discharge measurements made during 1904–1906 and is well defined below gage height 7 feet. Above gage height 8.80 feet the rating curve is a tangent, the difference being 50 per tenth.

Monthly discharge of Pea River at Pera, Ala., for 1906.

[Drainage area, 1,180 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	7,650	1,740	3,680	3.12	3.60
February	4,050	1,540	2,190	1.86	1.94
March	6,800	1,540	3,280	2.78	3.20
April	2,160	590	1,170	.992	1.11
May	5,000	528	1,480	1.25	1.44
June	2,260	414	752	.637	.71
July	5,700	468	2,060	1.75	2.02
August	2,450	414	857	.726	.84
September	8,250	342	1,150	.975	1.09
October	6,600	634	1,760	1.49	1.72
November	4,000	528	1,250	1.06	1.18
December	4,300	728	1,130	.958	1.10
The year	8,250	342	1,730	1.47	19.95

NOTE.—Values for 1906 are good.

MISCELLANEOUS MEASUREMENTS IN CHOCTAWHATCHEE RIVER DRAINAGE BASIN.

The following is a list of miscellaneous discharge measurements made in Choctawhatchee River drainage basin during 1906:

Pea River near Elba, Ala.—A measurement was made September 18, 1906, from a bateau about 700 feet below the Pea River Power Company's dam, which is located 6 miles from Elba, Ala. The stage of the river at this time was very low.

Width, 89 feet; area, 217 square feet; discharge, 197 second-feet.

Whitewater River at Elba, Ala.—Measurements were made from the downstream side of a single-span iron highway bridge in Elba, Ala. The bench mark is the center of the steel connecting pin which connects the second downstream vertical post from the right end of the bridge to the second floor beam; elevation, 42.44 feet above the datum of the assumed gage.

Discharge measurements of Whitewater River at Elba, Ala., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 21	W. E. Hall	65	242	5.14	585
June 8	F. A. Murray	54	119	3.26	115
September 19	do	49	105	3.03	60

ESCAMBIA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Escambia River drains the south-central portion of Alabama and empties into the Gulf of Mexico through Escambia Bay and Pensacola Bay. Conecuh River joins the Escambia about 5 miles south of the Alabama-Florida State line, and is very much the larger of the two branches. Conecuh River rises in Bullock County, Ala., very close to the headwaters of Pea River in the Choctawhatchee drainage, and flows southwestward throughout its course. Pigeon and Patsaliga creeks, both from the west, are the principal tributaries of Conecuh River. The Conecuh and its tributaries are swift streams and at places there are rocky shoals and rapids.

CONECUH RIVER AT BECK, ALA.

This station was established August 24, 1904. It is located at Simmons Bridge at Beck, Ala., about 12 miles below the mouth of Patsaliga Creek. The nearest railway station is Andalusia, Ala., 8 miles east, on the Central of Georgia and Louisville and Nashville railways. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 106, where are given also references to publications that contain data for previous years.

Discharge measurements of Conecuh River at Beck, Ala., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 23	W. E. Hall	121	654	5.18	1,680
June 7	F. A. Murray	115	332	2.06	431
September 13	do	118	469	3.22	871

Daily gage height, in feet, of Conecuh River at Beck, Ala., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.3	6.5	5.3	6.3	2.5	2.8	1.6	2.9	1.6	15.1	2.9	3.5
2	6.6	5.8	5.2	6.7	2.4	2.6	2.4	2.7	1.6	15.3	2.9	3.3
3	8.0	5.2	10.3	7.2	2.2	2.5	2.0	2.5	1.6	16.9	2.9	3.2
4	10.4	4.8	11.2	7.5	2.7	2.3	2.3	2.4	1.4	17.6	2.8	3.0
5	9.2	4.5	10.4	7.0	5.2	2.2	2.2	2.9	1.8	16.6	2.8	3.0

Daily gage height, in feet, of Conecuh River at Beck, Ala., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
6	7.8	4.2	8.5	6.1	6.0	2.2	2.3	2.5	2.1	16.3	2.7	2.9
7	7.7	4.5	7.6	5.4	6.5	2.1	2.3	2.3	1.9	14.1	2.7	2.9
8	6.8	6.0	10.4	4.7	7.3	1.9	2.35	2.2	1.8	11.8	2.7	2.8
9	6.9	8.1	11.3	4.3	7.1	1.9	2.45	2.0	2.8	9.0	2.6	2.8
10	6.6	8.8	11.0	4.2	6.2	2.1	2.5	1.9	3.0	7.6	2.6	3.0
11	6.5	7.7	9.7	4.2	5.9	2.0	3.7	3.9	4.5	6.9	2.6	3.3
12	6.8	7.2	9.2	4.2	5.6	1.9	4.8	4.8	4.3	6.4	2.6	3.4
13	6.6	6.8	8.8	4.1	5.9	2.2	4.1	3.0	3.3	5.5	2.5	3.4
14	6.0	7.1	8.9	4.1	5.7	2.6	4.2	7.2	3.0	5.2	2.5	3.3
15	5.8	7.5	10.5	5.8	4.8	3.2	6.2	5.5	2.6	4.5	3.5	3.2
16	5.5	7.2	9.7	6.2	4.2	2.7	7.3	4.3	2.8	4.3	3.1	3.1
17	5.2	7.0	8.4	5.6	3.4	2.7	6.8	3.7	2.8	4.0	3.2	3.3
18	4.9	6.1	7.6	5.3	3.1	2.7	6.7	3.1	2.3	3.9	4.5	3.4
19	5.0	5.4	6.8	4.9	2.9	2.4	7.7	2.8	2.0	3.8	4.9	3.9
20	5.1	5.1	6.7	4.5	2.7	2.8	7.4	2.6	1.9	3.8	4.9	4.0
21	5.3	5.4	6.7	4.1	2.7	2.4	6.1	2.4	1.8	3.7	5.0	3.9
22	6.5	5.3	6.2	3.7	2.7	1.9	6.2	2.4	2.1	3.6	5.2	3.8
23	8.9	5.2	6.3	3.5	2.6	1.8	5.9	2.2	2.4	3.6	4.9	3.8
24	9.0	5.0	6.2	3.2	2.6	1.8	4.9	2.0	2.8	3.6	4.7	3.7
25	7.6	5.2	6.1	3.0	3.0	1.7	4.2	1.8	2.6	3.5	4.5	3.6
26	7.3	5.6	6.3	2.9	3.1	1.6	4.0	1.8	2.4	3.4	4.4	3.4
27	7.2	5.4	6.0	2.8	3.2	1.5	4.4	1.9	6.0	3.3	4.2	3.2
28	7.6	5.7	6.0	2.7	3.7	1.5	5.1	1.9	16.0	3.2	4.0	3.2
29	8.4	.....	5.8	2.6	3.5	1.5	4.4	1.8	16.5	3.1	3.9	3.3
30	8.4	.....	5.8	2.5	3.5	1.5	4.4	1.7	16.3	3.0	3.8	3.4
31	7.6	.....	5.7	.....	3.1	.....	3.4	1.6	.....	3.0	.....	8.3

Rating table for Conecuh River at Beck, Ala., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	278	2.70	600	4.00	1,155	6.60	2,575
1.50	295	2.80	640	4.20	1,245	6.80	2,705
1.60	313	2.90	680	4.40	1,340	7.00	2,840
1.70	332	3.00	720	4.60	1,440	8.00	3,560
1.80	352	3.10	760	4.80	1,540	9.00	4,360
1.90	373	3.20	800	5.00	1,640	10.00	5,200
2.00	395	3.30	840	5.20	1,750	11.00	6,100
2.10	418	3.40	885	5.40	1,860	12.00	7,060
2.20	443	3.50	930	5.60	1,970	13.00	8,000
2.30	470	3.60	975	5.80	2,080	14.00	9,000
2.40	500	3.70	1,020	6.00	2,190		
2.50	530	3.80	1,065	6.20	2,315		
2.60	565	3.90	1,110	6.40	2,445		

NOTE.—The above table is based on discharge measurements made during 1904-1906 and is well defined below gage height 5.1 feet. Above 13 feet the rating curve is a tangent, the difference being 100 per tenth.

Monthly discharge of Conecuh River at Beck, Ala., for 1906.

[Drainage area, 1,290 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	5,560	1,590	2,940	2.28	2.63
February	4,200	1,240	2,260	1.75	1.82
March	6,380	1,750	3,620	2.81	3.24
April	3,190	530	1,530	1.19	1.33
May	3,050	443	1,260	.977	1.13
June	800	295	453	.351	.39
July	3,340	343	1,420	1.10	1.27
August	2,980	313	711	.551	.64
September	11,500	278	1,680	1.30	1.45
October	12,600	720	3,760	2.91	3.36
November	1,750	530	974	.755	.84
December	3,800	640	955	.740	.85
The year	12,600	278	1,800	1.39	18.95

NOTE.—Values for 1906 are good.

MISCELLANEOUS MEASUREMENT IN ESCAMBIA RIVER DRAINAGE BASIN.

The following miscellaneous discharge measurement was made in Escambia River drainage basin during 1906:

Conecuh River near Brantley, Ala.—A measurement was made June 6, 1906, at a logging railway bridge one-half mile southeast of Brantley, Ala. The bench mark is the top of the upstream end of the second wooden crossbeam from the right end of the bridge; elevation, 21 feet above the datum of the assumed gage.

Width, 60 feet; area, 266 square feet; gage height, 4.95 feet; discharge, 131 second-feet.

MOBILE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

This is the largest drainage basin in Georgia and Alabama and is designated the Mobile basin because its waters all enter the Gulf through Mobile River at Mobile, Ala. Beginning at the headwaters, Cartecay and Ellijay rivers unite at Ellijay, Ga., to form Coosawattee River. Just above Resaca, Ga., this unites with the Conasauga to form Oostanaula River. At Rome, Ga., the Oostanaula and the Etowah unite to form Coosa River. Six miles above Montgomery, Ala., the Coosa and the Tallapoosa unite to form Alabama River, and not far from the coast the Tombigbee unites with the Alabama to form Mobile River, which flows into Mobile Bay, an arm of the Gulf of Mexico.

Cahaba River is the principal tributary of the Alabama and joins it about 10 miles below Selma. Hillabee Creek flows into Tallapoosa River just above Sturdevant and near Alexander. Talladega Creek is a tributary of the Coosa.

Tombigbee River rises in the northeastern part of Mississippi and enters Alabama in Pickens County. Its principal tributary is the Black Warrior, which is formed by the junction of Mulberry Fork and Sipsey Fork. Locust Fork enters the Black Warrior some distance below the junction.

ALABAMA RIVER AT SELMA, ALA.

This station, which was originally established by the United States Engineer Corps, is now maintained by the United States Weather Bureau. It is located at the iron highway bridge one block from Water street, Selma, Ala. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 109, where are given also references to publications that contain data for previous years.

Discharge measurements of Alabama River at Selma, Ala., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 21	F. A. Murray	573	23,400	42.26	114,000
March 22	do	679	26,500	47.40	128,000
March 23	do	696	28,100	49.78	143,000
March 24	do	709	28,700	50.42	144,000
March 26	do	684	26,900	47.95	134,000
March 27	do	581	25,000	45.08	116,000
March 28	do	580	23,900	4[illegible].08	106,000
June 27	do	393	4,760	3.88	13,000
October 26	W. E. Hall	449	7,230	9.94	26,700

Daily gage height, in feet, of Alabama River at Selma, Ala., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	13.5	13.4	8.2	43.4	5.7	4.6	5.2	11.9	6.5	26.9	5.3	13.2
2	12.7	12.0	7.2	42.3	5.5	4.8	4.7	12.6	6.4	28.9	5.0	8.9
3	10.0	11.1	7.0	39.8	5.5	4.1	3.9	11.5	6.5	32.3	4.8	7.0
4	12.0	10.0	10.6	36.2	5.7	3.6	3.3	10.5	6.8	34.2	4.7	6.4
5	20.0	9.3	16.6	31.5	6.8	3.2	3.9	9.8	7.1	34.3	4.4	5.8
6	25.8	8.6	19.4	26.0	10.0	3.1	4.5	11.6	7.3	33.6	4.3	5.7
7	28.6	8.0	19.5	20.3	11.7	3.3	4.0	11.2	8.3	32.9	4.1	5.3
8	29.0	7.7	18.8	16.0	14.7	3.3	3.4	10.4	10.0	31.5	4.0	5.2
9	27.8	8.0	19.2	13.3	17.5	3.5	3.6	9.7	13.1	29.2	3.9	5.2
10	25.2	9.3	20.1	12.1	18.0	3.4	5.0	9.1	13.2	26.0	3.8	5.1
11	22.4	9.9	19.7	11.6	15.7	3.3	7.4	8.7	11.1	21.7	3.7	5.1
12	18.5	9.5	17.4	11.9	13.1	3.4	7.9	8.0	9.3	16.8	3.6	5.3
13	14.9	8.7	14.8	12.0	10.5	3.2	7.5	7.9	10.3	12.8	3.5	7.3
14	13.0	7.9	12.7	11.6	8.3	3.0	7.5	8.7	12.0	10.1	3.4	8.9
15	12.1	7.4	11.2	11.2	6.8	3.0	5.9	10.7	10.8	8.6	3.5	9.4
16	11.4	7.2	11.1	11.0	6.0	5.2	11.6	14.5	8.5	7.5	3.7	9.5
17	10.7	7.1	13.2	10.8	5.5	10.5	15.3	15.0	7.0	6.8	4.0	9.0
18	10.0	7.0	18.1	10.1	5.1	14.3	18.2	13.2	6.2	6.4	4.5	8.9
19	9.8	6.2	24.3	9.6	4.8	15.2	19.3	10.8	5.5	6.2	6.8	10.4
20	9.7	6.0	34.2	9.2	4.6	14.7	22.1	8.9	4.9	7.6	9.5	12.0
21	9.7	5.7	41.0	8.7	4.4	13.2	24.5	8.1	4.3	13.1	17.1	12.2
22	9.8	6.5	46.5	8.2	4.1	10.9	25.6	7.8	4.9	16.5	21.2	12.4
23	14.4	7.3	49.2	7.7	4.1	8.3	25.4	8.0	7.5	18.0	23.0	12.5
24	20.0	7.2	50.2	7.4	4.6	6.2	24.9	7.2	8.2	16.9	23.3	11.9
25	22.8	7.0	50.0	7.2	4.7	4.9	24.6	6.1	8.3	14.2	22.7	10.8
26	23.6	7.3	48.7	6.9	4.3	4.2	23.3	5.5	7.5	11.0	22.0	9.5
27	23.6	8.0	46.3	6.6	4.1	3.8	20.4	5.2	6.7	8.7	21.1	8.5
28	22.4	8.7	43.3	6.3	3.9	4.0	16.9	5.0	9.1	7.6	20.3	7.7
29	21.0	.....	42.5	6.0	3.8	4.1	13.5	5.5	15.1	6.6	19.6	7.5
30	18.9	.....	43.2	5.8	3.7	4.8	12.2	5.6	22.7	6.0	17.5	8.3
31	16.0	.....	43.6	.....	3.6	.....	11.9	6.1	.....	5.7	.....	10.6

Rating table for Alabama River at Selma, Ala., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.00	11,500	5.20	15,820	8.80	23,560	30.00	79,200
3.10	11,690	5.30	16,030	9.00	24,000	31.00	82,000
3.20	11,880	5.40	16,240	10.00	26,300	32.00	84,800
3.30	12,070	5.50	16,450	11.00	28,600	33.00	87,600
3.40	12,260	5.60	16,660	12.00	31,000	34.00	90,400
3.50	12,450	5.70	16,870	13.00	33,400	35.00	93,200
3.60	12,640	5.80	17,080	14.00	36,000	36.00	96,000
3.70	12,830	5.90	17,290	15.00	38,600	37.00	98,900
3.80	13,020	6.00	17,500	16.00	41,200	38.00	101,800
3.90	13,210	6.20	17,920	17.00	43,800	39.00	104,700
4.00	13,400	6.40	18,340	18.00	46,400	40.00	107,600
4.10	13,600	6.60	18,760	19.00	49,100	41.00	110,500
4.20	13,800	6.80	19,180	20.00	51,800	42.00	113,400
4.30	14,000	7.00	19,600	21.00	54,500	43.00	116,300
4.40	14,200	7.20	20,040	22.00	57,200	44.00	119,200
4.50	14,400	7.40	20,480	23.00	59,900	45.00	122,100
4.60	14,600	7.60	20,920	24.00	62,600	46.00	125,000
4.70	14,800	7.80	21,360	25.00	65,300	47.00	128,000
4.80	15,000	8.00	21,800	26.00	68,000	48.00	131,000
4.90	15,200	8.20	22,240	27.00	70,800	49.00	134,000
5.00	15,400	8.40	22,680	28.00	73,600	50.00	137,000
5.10	15,610	8.60	23,120	29.00	76,400	51.00	140,000

NOTE.—The above table is based on discharge measurements made during 1900–1906, and is well defined.

Monthly discharge of Alabama River at Selma, Ala., for 1906.

[Drainage area, 15,400 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	76,400	25,600	45,300	2.94	3.39
February	34,400	16,900	22,500	1.46	1.52
March	138,000	19,600	71,400	4.64	5.35
April	117,000	17,100	40,900	2.66	2.97
May	46,400	12,600	20,800	1.35	1.56
June	39,100	11,500	17,700	1.15	1.28
July	66,900	12,100	33,600	2.18	2.51
August	38,600	15,400	24,600	1.60	1.84
September	59,100	14,000	24,000	1.56	1.74
October	91,200	16,900	46,000	2.99	3.45
November	60,700	12,300	27,600	1.79	2.00
December	34,000	15,600	23,200	1.51	1.74
The year	138,000	11,500	33,100	2.15	29.35

NOTE.—Values for 1906 are excellent.

ETOWAH RIVER NEAR ROME, GA.

This station was established August 17, 1904. It is located at Freemans Ferry, about 5 miles above Rome, Ga. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 115, and in Water-Supply Paper No. 197, where are given also data for previous years.

Discharge measurements of Etowah River near Rome, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 8	F. A. Murray	307	1,310	3.85	3,690
June 27	O. P. Hall	305	1,140	3.30	2,850
October 16	F. A. Murray	300	988	2.88	2,180
October 16	do	300	988	2.89	2,160

Daily gage height, in feet, of Etowah River near Rome, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.9	3.8	2.6	5.4	3.3	2.7	2.6	4.0	3.4	10.8	2.75	2.8
2	2.8	3.5	2.6	5.0	3.1	2.9	2.5	3.9	3.1	8.8	2.75	2.8
3	3.9	3.4	4.8	4.5	3.0	3.0	2.5	3.8	2.8	7.9	2.7	2.8
4	15.4	3.4	5.6	4.1	3.5	3.0	2.9	3.7	2.7	6.8	2.7	2.8
5	13.3	3.3	4.9	4.0	3.3	2.9	2.8	3.6	2.7	4.8	2.7	2.7
6	6.5	3.3	3.5	3.9	3.1	2.8	2.6	3.5	5.5	4.5	2.7	2.7
7	4.3	3.2	3.0	3.8	4.0	2.7	3.0	3.3	4.0	4.1	2.7	2.7
8	3.9	3.2	3.0	3.7	4.2	2.6	2.7	3.1	3.9	4.0	2.65	2.7
9	4.0	3.2	4.8	3.6	3.3	2.6	2.6	2.8	4.8	3.8	2.65	2.7
10	3.8	3.1	4.0	4.5	3.0	2.5	3.2	2.7	3.3	3.4	2.6	2.9
11	3.5	3.1	3.5	4.0	2.9	2.5	3.0	3.2	3.3	3.2	2.6	3.8
12	3.5	3.0	3.2	3.5	2.9	3.0	2.8	2.8	3.2	3.2	2.6	3.6
13	3.7	3.0	3.1	3.4	2.8	7.3	2.6	2.7	3.1	3.0	2.6	3.6
14	3.5	3.0	3.2	3.4	2.8	9.5	2.5	2.9	2.9	3.0	2.6	3.6
15	3.4	3.0	13.4	4.0	2.8	7.7	5.5	3.2	2.8	2.9	2.65	3.5
16	3.0	3.0	16.7	3.7	2.7	7.8	4.7	4.0	2.6	2.8	2.7	3.2
17	4.0	2.9	9.4	3.5	2.7	6.5	3.5	4.2	2.5	2.85	2.8	3.0
18	3.6	2.9	5.8	3.5	2.6	3.6	10.5	4.9	2.5	4.0	3.0	4.8
19	3.4	2.8	14.3	3.4	2.6	3.3	8.8	5.0	3.1	8.5	12.9	4.5
20	3.5	2.8	22.7	3.3	2.6	3.1	6.0	3.3	4.8	4.5	10.5	4.0
21	3.2	2.8	20.0	3.3	2.6	3.0	4.3	4.2	3.6	3.6	9.0	4.0
22	7.3	2.9	10.0	3.2	2.6	2.9	4.7	4.0	3.6	3.3	9.0	3.8
23	11.3	3.0	5.3	3.2	2.6	2.8	4.8	4.0	3.5	3.2	8.5	3.4
24	10.7	2.8	4.5	3.1	2.5	2.7	5.3	3.9	3.5	3.1	7.5	3.4
25	5.5	2.8	4.2	3.1	2.5	2.7	3.6	3.5	3.4	3.0	4.0	3.2
26	4.5	2.8	4.0	3.1	2.5	4.4	3.2	3.3	3.4	3.0	3.0	3.0
27	4.5	2.7	4.1	3.0	5.1	3.4	3.0	3.2	3.3	2.9	3.0	3.4
28	4.7	2.7	4.9	3.2	3.7	3.0	2.9	3.0	3.2	2.9	2.9	3.4
29	4.5	.....	5.5	3.5	3.2	2.8	3.3	4.0	3.0	2.8	2.9	3.8
30	4.2	.....	6.0	3.4	2.9	2.7	4.6	4.2	3.2	2.8	2.8	3.7
31	4.0	.....	7.1	.....	2.8	.....	4.4	3.9	.....	2.8	.....	9.8

Rating table for Etowah River near Rome, Ga., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	570	2.90	2,175	4.60	5,100	9.00	15,180
1.60	650	3.00	2,320	4.80	5,480	10.00	17,880
1.70	735	3.10	2,470	5.00	5,860	11.00	20,700
1.80	830	3.20	2,625	5.20	6,260	12.00	23,600
1.90	930	3.30	2,785	5.40	6,660	13.00	26,660
2.00	1,035	3.40	2,950	5.60	7,080	14.00	29,800
2.10	1,145	3.50	3,120	5.80	7,500	15.00	33,000
2.20	1,260	3.60	3,295	6.00	7,930	16.00	36,300
2.30	1,380	3.70	3,470	6.20	8,370	17.00	39,600
2.40	1,500	3.80	3,645	6.40	8,820	18.00	43,000
2.50	1,625	3.90	3,820	6.60	9,280	19.00	46,500
2.60	1,755	4.00	4,000	6.80	9,740	20.00	50,000
2.70	1,890	4.20	4,360	7.00	10,200		
2.80	2,030	4.40	4,720	8.00	12,600		

NOTE.—The above table is based on discharge measurements made during 1904–1906 and is well defined below gage height 4 feet. Above gage height 7 feet the curve becomes uncertain and is only approximate at the high stages.

Monthly discharge of Etowah River near Rome, Ga., for 1905–6.

[Drainage area, 1,800 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
January	35,300	930	3,350	1.86	2.14
February	20,700	1,140	5,250	2.92	3.04
March	4,910	1,620	2,160	1.20	1.38
April	2,320	1,380	1,720	.956	1.07
May	15,200	1,380	2,940	1.63	1.88
June	3,640	1,260	1,610	.894	1.00
July	10,200	1,140	2,650	1.47	1.70
August	6,060	930	1,840	1.02	1.18
September	2,320	650	1,050	.583	.65
October	3,470	650	1,310	.728	.84
November	2,780	570	985	.547	.61
December	37,000	1,040	[a] 7,130	3.96	4.56
The year	37,000	570	2,670	1.48	20.05
1906.					
January	34,300	2,030	6,990	3.88	4.47
February	3,640	1,890	2,410	1.34	1.40
March	59,400	1,760	11,700	6.50	7.49
April	6,660	2,320	3,460	1.92	2.14
May	6,060	1,620	2,430	1.35	1.56
June	16,500	1,620	3,900	2.17	2.42
July	19,300	1,620	4,170	2.32	2.68
August	5,860	1,890	3,350	1.86	2.14
September	6,870	1,620	2,940	1.63	1.82
October	20,100	2,030	4,750	2.64	3.04
November	26,400	1,760	5,010	2.78	3.10
December	17,300	1,890	3,580	1.99	2.29
The year	59,400	1,620	4,560	2.53	34.55

[a] December 21–23 estimated.

NOTE.—Values for 1905 and 1906 are excellent, except March, 1906, which is good.

COOSA RIVER AT RIVERSIDE, ALA.

This station was established September 25, 1896. It is located at the Southern Railway bridge, Riverside, Ala., about 4 miles below Lock No. 4. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 119, where are given also references to publications that contain data for previous years.

Discharge measurements of Coosa River at Riverside, Ala., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 29	F. A. Murray	564	9,630	12.40	44,200
March 29	do	564	9,640	12.45	44,700
March 30	do	564	9,490	12.10	43,300
April 19	do	553	5,130	4.16	11,100
June 21	do	543	4,960	4.03	10,300
August 30	M. R. Hall	543	4,590	3.78	9,780
October 24	W. E. Hall	546	5,290	4.77	12,800

Daily gage height, in feet, of Coosa River at Riverside, Ala., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.9	5.6	2.8	10.8	3.3	2.55	2.6	6.0	3.8	7.5	2.85	3.8
2	4.4	5.2	2.8	10.6	3.15	2.35	2.35	5.5	4.1	11.5	2.8	3.5
3	6.0	4.8	6.0	9.3	3.0	2.3	2.25	4.9	4.4	12.4	2.8	3.4
4	8.8	4.6	8.5	8.4	3.0	2.5	2.4	4.5	4.5	12.5	2.7	3.3
5	10.4	4.4	8.9	6.9	3.2	2.75	2.5	5.0	4.2	12.3	2.6	3.25
6	11.7	4.0	8.3	6.0	3.4	2.85	2.5	5.4	3.7	12.0	2.55	3.2
7	11.9	3.6	7.1	5.5	4.0	2.85	2.5	5.1	5.3	11.0	2.5	3.15
8	10.7	3.6	6.0	5.1	3.9	2.9	3.2	5.2	4.6	9.5	2.45	3.1
9	7.3	3.6	5.2	4.8	4.2	2.95	3.2	4.8	4.5	8.3	2.4	3.05
10	6.1	3.4	4.9	5.5	4.2	2.75	3.3	4.3	4.4	6.8	2.4	3.45
11	5.8	3.2	5.2	5.6	3.6	2.25	2.65	3.7	5.4	5.5	2.4	4.8
12	5.5	3.1	4.7	5.6	3.2	2.0	2.55	3.7	4.9	4.8	2.35	5.0
13	5.5	3.05	4.2	6.1	2.85	2.0	2.55	3.9	4.4	4.2	2.3	5.8
14	5.4	3.0	3.8	5.4	2.7	2.0	2.8	3.5	3.9	3.9	2.3	5.5
15	5.2	3.0	3.6	4.9	2.65	5.2	5.8	3.5	3.85	3.55	2.35	5.0
16	5.2	3.0	10.5	4.4	2.55	8.5	7.5	4.2	3.7	3.3	2.5	4.1
17	5.1	2.9	12.9	4.3	2.5	9.5	7.4	4.1	3.2	3.2	2.5	4.0
18	5.1	2.8	13.5	4.3	2.4	9.0	10.6	4.0	2.8	3.2	2.75	4.4
19	5.1	2.7	16.1	4.2	2.35	7.6	12.3	4.0	2.45	6.0	7.7	4.9
20	5.0	2.55	19.8	3.95	2.3	5.9	12.9	4.4	2.45	8.6	10.9	5.7
21	4.8	2.5	18.4	3.7	2.3	4.2	12.1	4.9	4.0	9.4	12.5	6.2
22	5.6	2.5	17.1	3.6	2.25	3.5	11.2	3.9	4.9	8.2	12.9	5.9
23	7.0	2.7	16.1	3.5	2.2	3.1	10.3	3.6	4.6	6.2	12.8	5.4
24	8.9	3.1	15.3	3.4	2.15	2.85	9.0	3.3	4.0	4.9	12.7	5.0
25	10.4	3.4	14.9	3.3	2.15	2.6	7.4	3.1	3.8	4.0	12.4	4.1
26	11.1	3.25	13.9	3.2	2.1	2.6	7.2	3.45	3.9	3.65	12.1	4.0
27	10.2	3.1	10.2	3.1	2.1	2.8	6.9	3.45	3.45	3.5	10.8	3.95
28	9.1	3.0	11.8	3.0	2.15	3.7	4.7	4.0	3.3	3.35	9.4	3.9
29	8.0	.....	12.3	3.0	2.75	3.35	4.0	4.5	3.3	3.15	5.1	4.6
30	6.4	.....	12.2	3.15	3.55	2.95	5.0	3.8	5.3	3.05	4.1	5.0
31	6.2	.....	11.2	.....	2.95	.....	6.4	3.65	.....	2.95	.....	9.5

Rating table for Coosa River at Riverside, Ala., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	4,380	3.30	8,060	4.60	12,360	6.80	20,640
2.10	4,635	3.40	8,380	4.70	12,710	7.00	21,440
2.20	4,895	3.50	8,700	4.80	13,070	7.20	22,260
2.30	5,160	3.60	9,020	4.90	13,430	7.40	23,080
2.40	5,425	3.70	9,340	5.00	13,800	7.60	23,920
2.50	5,695	3.80	9,660	5.20	14,540	7.80	24,760
2.60	5,970	3.90	9,980	5.40	15,280	8.00	25,600
2.70	6,250	4.00	10,300	5.60	16,020	9.00	29,800
2.80	6,540	4.10	10,630	5.80	16,760	10.00	34,060
2.90	6,835	4.20	10,970	6.00	17,500	11.00	38,320
3.00	7,135	4.30	11,310	6.20	18,270		
3.10	7,440	4.40	11,660	6.40	19,050		
3.20	7,750	4.50	12,010	6.60	19,840		

NOTE.—The above table is based on discharge measurements made during 1905-1906 and is well defined below gage height 13 feet. Above gage height 9 feet the rating curve is a tangent, the difference being 426 per tenth.

Monthly discharge of Coosa River at Riverside, Ala., for 1906.

[Drainage area, 7,060 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	42,200	11,700	22,600	3.20	3.69
February	16,000	5,700	8,530	1.21	1.26
March	75,800	6,540	34,400	4.87	5.62
April	37,500	7,140	14,800	2.10	2.34
May	11,000	4,640	6,850	.970	1.12
June	31,900	4,380	10,100	1.43	1.60
July	46,400	5,030	17,000	2.49	2.87
August	17,500	7,440	11,200	1.59	1.83
September	15,300	5,560	10,500	1.49	1.66
October	44,700	6,980	20,400	2.89	3.33
November	46,400	5,160	17,700	2.51	2.80
December	31,900	7,290	12,300	1.74	2.01
The year	75,800	4,380	15,600	2.21	30.13

NOTE.—Values for 1906 are excellent.

OOSTANAULA RIVER AT RESACA, GA.

This station was maintained by the United States Geological Survey from August 1, 1896, to April 30, 1899, and was reestablished at the beginning of 1905; gage-height records are maintained half the year by the United States Weather Bureau. It is located at the bridge of the Western and Atlantic Railway in the town of Resaca, 800 feet south of the station. A standard gage belonging to the United States Geological Survey is located on the downstream side of the bridge at the middle of the first span from the right bank; length of chain, 41.35 feet. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 121, and in Water-Supply Paper No. 197, where are given also data for previous years.

Discharge measurements of Oostanaula River at Resaca, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 2	M. R. Hall	156	1,080	4.60	2,170
May 22	O. P. Hall	138	944	3.42	1,510
June 6	do	165	1,340	5.51	3,080
June 28	do	158	1,080	4.37	2,120
July 26	M. R. Hall	163	1,280	5.97	3,290

Daily gage height, in feet, of Oostanaula River at Resaca, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.8	6.6	3.8	11.8	4.6	3.6	3.8	6.3	9.6	17.3	4.0	4.2
2	4.6	6.4	3.8	8.8	4.4	3.6	3.8	7.6	8.3	17.6	4.0	4.0
3	8.6	5.8	6.8	7.6	4.4	4.6	3.6	5.9	5.0	18.1	4.0	3.8
4	17.5	5.4	10.6	6.6	7.0	4.2	3.6	6.4	5.0	17.8	3.9	3.8
5	17.6	5.0	9.2	6.2	5.4	4.2	3.4	8.6	4.6	15.9	3.9	3.6
6	13.6	5.2	6.2	6.2	5.0	6.6	3.4	7.4	4.8	12.6	3.9	3.8
7	7.6	5.0	5.4	6.0	6.0	4.6	3.4	7.9	4.9	11.0	3.8	4.6
8	6.4	4.8	5.8	5.8	5.4	4.0	3.2	6.0	4.5	10.7	3.8	4.6
9	7.2	4.8	6.2	5.6	5.2	3.8	3.2	5.2	5.9	8.2	3.7	4.8
10	6.8	4.8	5.4	8.6	4.8	3.8	3.4	4.9	4.9	6.6	3.7	6.4

Daily gage height, in feet, of Oostanaula River at Resaca, Ga., in 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	6.2	4.6	4.0	7.0	4.6	3.6	3.4	5.2	4.9	6.0	3.6	8.6
12	6.8	4.2	4.8	6.2	4.2	3.8	3.2	4.5	7.2	5.6	3.6	7.3
13	6.2	4.2	4.6	5.8	4.2	10.6	3.2	4.4	7.5	5.2	3.6	6.4
14	5.9	4.2	4.4	5.2	4.0	17.5	3.6	8.6	6.5	5.0	3.5	5.8
15	6.0	4.2	19.1	6.6	4.0	17.0	9.0	5.0	4.8	4.8	4.4	4.6
16	5.6	4.0	21.8	6.4	4.0	15.6	8.6	7.5	4.3	4.7	4.4	4.2
17	6.2	4.0	20.8	5.6	3.9	13.2	9.8	6.2	4.0	4.6	4.8	4.6
18	5.6	4.0	13.4	5.2	3.8	7.6	14.6	5.2	3.8	9.4	7.8	8.6
19	5.6	3.8	13.4	5.0	3.8	6.0	15.4	5.8	6.6	13.8	23.0	9.6
20	5.4	3.8	19.6	4.8	3.8	5.2	16.4	5.1	7.5	11.5	29.0	8.4
21	5.2	3.8	17.2	4.8	3.6	5.0	14.6	5.1	6.9	7.4	30.0	7.6
22	10.2	5.0	12.4	4.4	3.6	4.6	10.0	4.6	6.2	5.8	27.8	6.6
23	17.2	4.2	8.2	4.4	3.4	4.4	12.2	4.9	6.2	5.4	24.0	6.4
24	17.4	4.2	7.4	4.4	3.2	4.8	11.0	4.8	6.4	5.1	16.0	6.4
25	11.4	4.0	6.6	4.4	3.2	5.8	8.6	5.2	6.0	4.9	7.6	6.8
26	8.4	4.0	6.2	4.4	3.2	5.0	6.0	4.9	5.2	4.7	5.8	6.6
27	8.2	3.8	6.7	4.4	6.4	4.6	5.4	5.8	4.7	4.6	5.4	6.3
28	9.2	3.8	8.2	5.6	4.4	4.0	5.0	5.1	4.4	4.4	4.9	6.0
29	8.2	.....	9.2	5.4	4.0	3.8	5.8	4.8	4.3	4.3	4.7	6.0
30	7.8	.....	10.8	5.2	4.0	3.8	8.1	5.9	6.3	4.2	4.5	7.5
31	7.8	.....	13.8	.....	3.8	.....	7.4	7.8	.....	4.2	.....	14.2

Rating table for Oostanaula River at Resaca, Ga., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.20	1,290	4.60	2,[illegible]20	6.00	3,340	8.80	6,060
3.30	1,350	4.70	2,305	6.20	3,520	9.00	6,280
3.40	1,410	4.80	2,380	6.40	3,700	10.00	7,420
3.50	1,475	4.90	2,455	6.60	3,880	11.00	8,640
3.60	1,540	5.00	2,530	6.80	4,060	12.00	9,930
3.70	1,605	5.10	2,610	7.00	4,250	13.00	11,280
3.80	1,670	5.20	2,690	7.20	4,450	14.00	12,680
3.90	1,735	5.30	2,770	7.40	4,650	15.00	14,120
4.00	1,800	5.40	2,850	7.60	4,850	16.00	15,600
4.10	1,870	5.50	2,930	7.80	5,050	17.00	17,100
4.20	1,940	5.60	3,010	8.00	5,250	18.00	18,600
4.30	2,010	5.70	3,090	8.20	5,450		
4.40	2,080	5.80	3,170	8.40	5,650		
4.50	2,155	5.90	3,250	8.60	5,850		

NOTE.—The above table is based on eleven discharge measurements made during 1904–1906 and is well defined below gage height 6 feet. Above gage height 16 feet the rating curve is a tangent, the difference being 150 per tenth.

Monthly discharge of Oostanaula River at Resaca, Ga., for 1906.

[Drainage area, 1,610 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	18,000	2,230	6,330	3.93	4.53
February	3,880	1,670	2,220	1.38	1.44
March	21,300	1,670	7,760	4.82	5.56
April	9,670	2,080	3,410	2.12	2.36
May	4,250	1,290	2,100	1.30	1.50
June	17,800	1,540	4,220	2.62	2.92
July	16,200	1,290	4,880	3.03	3.49
August	5,850	2,080	3,320	2.06	2.38
September	6,940	1,670	3,180	1.98	2.21
October	18,800	1,940	6,460	4.01	4.62
November	36,600	1,480	7,560	4.70	5.24
December	13,000	1,540	3,710	2.30	2.65
The year	36,600	1,290	4,600	2.86	38.90

NOTE.—Values are rated as follows: March and November good; remainder of 1906 excellent.

COOSAWATTEE RIVER AT CARTERS, GA.

This gaging station was established August 15, 1896, at the iron highway bridge at Carters, Murray County, Ga. It is at the foot of the great shoals made by this stream in cutting through the Cohutta Mountains. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 124, and in Water-Supply Paper No. 197, where are given also data for previous years.

Discharge measurements of Coosawattee River at Carters, Ga., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 17	O. P. Hall	115	615	4.38	2,140
March 30	do	127	1,130	8.25	4,540
June 5	do	112	1,080	7.90	4,660

Daily gage height, in feet, of Coosawattee River at Carters, Ga., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.4	3.2	2.3	4.6	2.8	2.5	2.1	3.0	2.8	7.0	2.3	2.9
2	3.0	3.2	2.4	4.0	2.8	3.0	2.1	4.0	2.8	6.0	2.3	2.8
3	10.5	3.1	5.0	3.9	4.2	2.6	2.4	3.5	2.7	5.6	2.3	2.8
4	4.0	3.1	4.0	3.7	3.3	2.5	2.5	3.0	2.6	5.0	2.2	2.8
5	3.0	3.0	3.0	3.5	3.0	5.5	2.3	7.0	2.6	5.0	2.2	2.7
6	2.6	3.0	2.9	3.6	5.0	3.0	2.2	5.0	2.5	4.8	2.1	2.8
7	2.5	3.2	2.8	4.0	3.9	2.5	2.2	3.5	2.5	4.5	2.1	2.8
8	2.5	3.2	2.8	3.8	3.6	2.5	2.1	3.0	7.0	4.3	2.1	2.7
9	2.8	3.0	2.8	5.0	3.0	2.4	2.3	2.6	4.0	3.5	2.2	2.7
10	3.0	2.9	2.7	4.5	2.8	2.4	2.3	2.8	3.5	3.3	2.3	4.5
11	3.5	2.9	2.7	4.0	2.6	2.8	2.2	3.0	3.4	3.1	2.4	3.2
12	3.0	2.8	2.7	3.0	2.6	2.7	2.2	2.8	3.0	3.0	2.4	3.0
13	2.5	2.7	3.0	2.8	2.5	14.0	2.1	2.6	2.8	2.9	2.3	2.8
14	2.5	2.6	4.0	2.8	2.5	5.5	3.5	2.6	2.7	2.8	2.3	2.8
15	2.5	2.5	18.8	4.0	2.5	8.0	2.5	2.5	2.7	2.7	2.4	2.8
16	3.6	2.4	6.0	3.6	2.4	5.0	2.0	2.5	2.6	2.6	2.4	3.0
17	3.5	2.4	5.0	3.4	2.4	4.5	3.0	2.5	2.5	2.6	2.6	3.6
18	3.5	2.4	4.8	3.2	2.3	3.5	5.5	2.6	2.5	5.0	13.2	4.0
19	3.6	2.4	13.0	3.1	2.3	3.0	8.2	2.8	5.0	3.5	26.0	4.8
20	3.6	2.4	7.0	3.0	2.2	2.8	5.0	2.7	4.0	3.3	9.4	3.8
21	3.8	2.4	5.0	3.0	2.2	2.7	4.2	2.6	3.0	3.1	5.4	3.7
22	10.5	2.6	4.0	3.0	2.1	2.6	5.0	2.5	2.8	3.0	4.8	3.7
23	11.0	2.5	3.8	2.9	2.1	2.5	4.6	2.5	2.5	3.8	4.0	3.6
24	6.5	2.5	3.7	2.9	2.1	3.1	4.0	2.8	2.6	3.6	3.6	3.6
25	4.5	2.5	3.6	2.8	2.1	3.0	3.5	2.7	4.2	3.4	3.4	3.6
26	4.0	2.4	3.5	2.8	7.0	2.9	3.0	2.6	2.8	3.2	3.2	3.5
27	3.5	2.4	4.3	2.7	3.0	2.8	3.5	2.6	2.6	3.0	3.1	3.5
28	3.5	2.4	4.2	4.0	2.8	2.5	3.5	2.8	2.5	2.6	3.05	4.5
29	3.4	.....	4.1	3.0	2.6	2.4	4.0	2.7	2.5	2.4	3.0	5.0
30	3.4	.....	8.5	3.0	2.5	2.3	4.7	2.6	4.0	2.4	3.0	5.0
31	3.3	.....	5.4	.....	2.5	.....	3.1	3.0	.....	2.4	.....	9.0

Rating table for Coosawattee River at Carters, Ga., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	785	2.80	1,170	3.60	1,620	4.80	2,410
2.10	830	2.90	1,220	3.70	1,680	5.00	2,550
2.20	875	3.00	1,275	3.80	1,740	5.20	2,694
2.30	920	3.10	1,330	3.90	1,805	5.40	2,838
2.40	970	3.20	1,385	4.00	1,870	5.60	2,982
2.50	1,020	3.30	1,440	4.20	2,000	5.80	3,126
2.60	1,070	3.40	1,500	4.40	2,130	6.00	3,270
2.70	1,120	3.50	1,560	4.60	2,270	7.00	3,990

NOTE.—The above table is based on discharge measurements made during 1902–1906 and is well defined below gage height 8 feet. Above gage height 5 feet the rating curve is a tangent, the difference being 72 per tenth.

Monthly discharge of Coosawattee River at Carters, Ga., for 1906.

[Drainage area, 531 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	6,870	970	1,990	3.75	4.32
February	1,380	970	1,130	2.13	2.22
March	12,500	920	2,480	4.67	5.38
April	2,550	1,120	1,550	2.92	3.26
May	3,990	830	1,260	2.37	2.73
June	9,030	920	1,710	3.22	3.59
July	4,850	785	1,510	2.84	3.27
August	3,990	1,020	1,320	2.49	2.87
September	3,990	1,020	1,380	2.60	2.90
October	3,990	970	1,710	3.22	3.71
November	17,700	830	2,140	4.03	4.50
December	5,430	1,120	1,670	3.15	3.63
The year	17,700	785	1,650	3.12	42.38

NOTE.—Values are rated as follows: January February, April to October, and December, excellent; March and November are only good, owing to liability of backwater at high stages.

CHOCCOLOCCO CREEK NEAR JENIFER, ALA.

The gage at this station was established August 20, 1902. It is located at the Louisville and Nashville Railroad bridge, 1¼ miles north of Jenifer, Ala. There are small shoals both above and below the bridge. The conditions[a] at this station and the bench marks are described in Water-Supply Paper No. 168, page 130, where are given also references to publications that contain data for previous years.

Discharge measurements of Choccolocco Creek near Jenifer, Ala., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 16	M. R. Hall	144	582	5.85	2,330
March 16	F. A. Murray	144	585	5.85	2,290
April 18	do	107	231	2.84	412
June 20	do	102	178	2.40	225
June 20	do	102	178	2.41	218
August 29	M. R. Hall	100	205	2.62	336

Daily gage height, in feet, of Choccolocco Creek near Jenifer, Ala., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.9	2.7	2.3	4.4	2.5	2.3	2.15	2.8	2.7	6.1	2.6	2.7
2	2.75	2.65	2.3	3.9	2.45	2.3	2.2	2.7	3.0	7.1	2.7	2.7
3	2.9	2.6	2.6	3.5	2.4	2.3	2.3	2.9	2.7	6.9	2.5	2.65
4	5.4	2.6	3.7	3.4	2.5	2.3	2.2	2.8	2.6	5.1	2.8	2.6
5	5.6	2.5	3.3	3.3	2.85	2.25	2.2	3.6	2.5	4.0	2.5	2.6
6	4.4	2.5	3.3	3.2	3.0	2.2	2.1	3.1	4.0	3.8	2.5	2.6
7	3.45	2.5	2.85	3.1	3.5	2.3	2.1	3.0	6.4	3.6	2.5	2.6
8	3.3	2.5	2.7	3.0	3.5	2.2	4.4	2.9	5.1	3.3	2.5	2.6
9	3.2	2.5	3.1	2.9	2.9	2.2	3.9	2.8	3.5	3.1	2.5	2.5
10	2.9	2.5	2.9	3.7	2.7	2.2	2.7	2.7	4.4	3.0	2.5	2.5
11	3.0	2.45	2.8	3.4	2.6	2.2	2.5	2.7	4.0	2.9	2.5	4.5
12	3.0	2.4	2.8	3.1	2.5	2.1	2.4	4.1	3.2	2.8	2.5	4.5
13	3.0	2.4	2.6	3.0	2.5	2.1	2.3	3.6	3.4	2.7	2.5	3.2
14	2.9	2.4	2.5	3.0	2.45	2.2	2.5	4.6	2.9	2.7	2.5	3.0
15	2.8	2.4	4.1	3.2	2.45	3.7	6.7	6.5	2.8	2.6	2.8	2.9

[a] A second section of the gage is attached to the upstream wing wall of the left bank abutment, reading from 10 feet to 15 feet.

Daily gage height, in feet, of Choccolocco Creek near Jenifer, Ala., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	2.8	2.35	5.2	3.0	2.4	3.8	5.0	4.5	2.7	2.7	2.8	2.8
17	2.9	2.3	5.6	2.9	2.4	2.8	3.2	3.6	2.6	2.6	2.5	3.1
18	2.8	2.3	3.6	2.8	2.4	2.5	6.9	3.0	2.7	3.9	2.5	3.1
19	2.9	2.3	11.5	2.75	2.4	2.45	8.4	2.9	2.6	4.9	4.5	3.5
20	2.9	2.3	14.2	2.7	2.4	2.5	6.5	2.9	2.6	4.5	5.2	3.4
21	2.9	2.3	7.5	2.7	2.4	2.4	4.5	3.0	2.8	3.5	5.5	3.3
22	3.2	2.4	5.2	2.7	2.4	2.3	3.5	2.7	2.8	3.0	4.6	3.2
23	4.6	2.4	4.3	2.65	2.35	2.3	4.0	2.6	2.7	3.0	3.2	3.1
24	4.5	2.4	3.8	2.65	2.3	2.3	4.4	2.6	2.6	2.9	3.0	3.0
25	3.6	2.4	3.6	2.6	2.25	2.2	3.5	2.6	2.9	2.9	2.9	2.9
26	3.25	2.4	3.3	2.55	2.3	2.2	3.1	2.85	2.7	2.8	2.8	2.8
27	3.1	2.4	3.3	2.5	2.3	2.3	2.8	2.6	2.6	2.8	2.8	2.8
28	3.0	2.4	5.6	2.5	2.4	2.2	2.8	3.2	2.6	2.7	2.7	2.9
29	2.9	.....	5.8	2.5	2.3	2.2	2.8	2.6	2.6	2.7	2.7	3.4
30	2.8	.....	5.3	2.5	2.3	2.2	3.1	2.7	4.1	2.6	2.7	3.6
31	2.75	.....	4.9	.....	2.3	.....	3.1	3.0	.....	2.7	.....	6.0

Rating table for Choccolocco Creek near Jenifer, Ala., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	125	3.20	560	4.40	1,195	6.20	2,620
2.10	145	3.30	605	4.50	1,260	6.40	2,800
2.20	170	3.40	650	4.60	1,325	6.60	3,000
2.30	200	3.50	700	4.70	1,395	6.80	3,200
2.40	235	3.60	750	4.80	1,465	7.00	3,400
2.50	270	3.70	800	4.90	1,535	8.00	4,500
2.60	305	3.80	850	5.00	1,610	9.00	5,600
2.70	345	3.90	905	5.20	1,760	10.00	6,800
2.80	385	4.00	960	5.40	1,920	11.00	8,000
2.90	425	4.10	1,015	5.60	2,080		
3.00	470	4.20	1,075	5.80	2,260		
3.10	515	4.30	1,135	6.00	2,440		

NOTE.—The above table is based on discharge measurements made during 1903-1906 and is well defined below gage height 6 feet. Above gage height 9 feet the rating curve is a tangent, the difference being 120 per tenth.

Monthly discharge of Choccolocco Creek near Jenifer, Ala., for 1906.

[Drainage area, 272 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	2,080	365	645	2.37	2.73
February	345	200	248	.912	.95
March	11,800	200	1,590	5.85	6.74
April	1,200	270	483	1.78	1.99
May	700	185	287	1.06	1.22
June	850	145	240	.882	.98
July	4,940	145	920	3.38	3.90
August	2,900	305	588	2.16	2.49
September	2,800	270	593	2.18	2.43
October	3,510	305	836	3.07	3.54
November	2,000	270	497	1.83	2.04
December	2,440	270	562	2.07	2.39
The year	11,800	145	624	2.30	31.40

NOTE.—Values for 1906 are excellent.

TALLAPOOSA RIVER AT STURDEVANT, ALA.

This station was established July 19, 1900. It is located at the Columbus and Western Railroad bridge, one-fourth mile west of Sturdevant. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 132, where are given also references to publications that contain data for previous years.

Discharge measurements of Tallapoosa River at Sturdevant, Ala., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 17	M. R. Hall	411	3,870	6.36	10,500
March 17	F. A. Murray	411	3,880	6.36	10,100
June 8	M. R. Hall	346	2,420	2.18	1,770

Daily gage height, in feet, of Tallapoosa River at Sturdevant, Ala., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.15	3.45	2.85	5.4	2.85	2.3	2.0	3.6	4.5	8.6	2.9	2.9
2	3.0	3.3	2.8	4.8	2.8	2.2	2.5	3.9	4.3	8.1	2.85	2.9
3	6.8	3.2	5.4	4.4	2.75	2.2	4.4	4.4	3.8	7.4	2.8	2.85
4	12.4	3.1	5.6	4.2	3.1	2.15	3.7	6.0	4.1	6.2	2.8	2.9
5	9.0	3.1	5.1	4.0	4.3	2.2	3.1	4.3	3.9	5.0	2.7	2.85
6	7.5	3.0	4.0	3.9	4.2	2.5	2.9	4.5	7.0	4.7	2.7	2.8
7	5.2	3.1	3.4	3.7	4.8	2.25	2.35	4.6	9.1	4.3	2.7	2.95
8	4.3	3.2	6.8	3.6	6.7	2.2	3.0	4.0	5.4	3.8	2.7	2.95
9	3.9	3.45	6.4	3.5	4.9	2.1	6.5	3.1	4.3	3.5	2.65	2.95
10	3.6	3.35	5.2	3.8	4.1	2.0	4.4	2.8	5.4	3.25	2.7	2.9
11	3.6	3.3	4.5	4.0	3.5	2.15	4.0	4.0	5.5	3.05	2.65	3.5
12	3.65	3.2	4.1	4.5	3.2	2.2	3.0	4.7	6.7	2.95	2.6	4.7
13	3.55	3.15	3.75	3.9	3.1	2.3	2.9	4.0	4.7	2.9	2.6	4.0
14	3.45	3.1	3.6	3.9	3.0	5.4	3.4	9.4	3.9	2.8	2.65	3.6
15	3.35	3.1	6.1	4.2	2.95	8.3	8.5	6.3	3.4	2.75	2.95	3.25
16	3.3	3.0	6.5	4.1	2.8	6.8	7.0	5.5	3.05	2.7	3.25	3.05
17	3.25	2.9	6.7	3.9	2.75	5.0	5.1	4.3	2.9	2.7	3.05	4.9
18	3.25	2.8	5.0	3.6	2.7	4.1	5.6	3.5	2.8	5.3	3.45	6.5
19	3.2	2.8	18.8	3.5	2.65	3.5	6.4	4.2	2.7	9.4	9.6	5.4
20	3.2	2.75	21.6	3.4	2.6	3.1	7.8	4.1	3.25	7.8	7.1	5.1
21	3.5	3.8	14.6	3.35	2.5	2.7	5.5	3.7	3.6	6.6	6.3	4.7
22	6.8	3.7	12.0	3.3	2.7	2.55	4.0	3.4	3.8	4.7	4.8	4.3
23	7.9	3.5	9.2	3.3	2.6	2.4	5.8	3.35	3.6	3.9	4.1	3.9
24	6.5	3.25	5.6	3.25	2.5	2.3	6.5	3.25	3.8	3.5	3.6	3.6
25	5.7	3.35	4.6	3.15	2.45	2.15	5.5	3.25	3.7	3.4	3.35	3.4
26	4.5	3.15	4.3	3.1	2.4	2.25	4.3	4.0	3.6	3.35	3.2	3.3
27	4.2	3.05	4.5	3.05	2.5	2.8	4.0	3.35	3.25	3.15	3.15	3.25
28	4.0	2.9	7.6	3.0	2.55	3.1	3.3	3.4	3.6	3.05	3.05	3.45
29	3.85	.....	8.2	3.0	2.6	2.9	3.6	5.2	4.6	2.95	2.95	4.1
30	3.8	.....	7.2	2.95	2.5	2.4	4.4	3.8	5.6	2.9	2.9	4.4
31	3.6	.....	6.2	.....	2.4	.....	4.7	4.3	.....	2.85	.....	9.7

A. DAM AND POWER HOUSE OF MONTGOMERY POWER COMPANY ON TALLAPOOSA RIVER ABOVE TALLASSEE, ALA.

B. INTERIOR OF POWER HOUSE OF MONTGOMERY POWER COMPANY ON TALLAPOOSA RIVER ABOVE TALLASSEE, ALA.

Rating table for Tallapoosa River at Sturdevant, Ala., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	1,400	3.10	2,880	4.20	4,870	5.60	8,330
2.10	1,500	3.20	3,030	4.30	5,090	5.80	8,880
2.20	1,670	3.30	3,190	4.40	5,310	6.00	9,440
2.30	1,790	3.40	3,350	4.50	5,540	6.20	10,000
2.40	1,910	3.50	3,520	4.60	5,770	6.40	10,560
2.50	2,040	3.60	3,690	4.70	6,010	6.60	11,140
2.60	2,170	3.70	3,870	4.80	6,250	6.80	11,740
2.70	2,300	3.80	4,060	4.90	6,500	7.00	12,350
2.80	2,440	3.90	4,250	5.00	6,760	7.20	12,990
2.90	2,580	4.00	4,450	5.20	7,280	7.40	13,630
3.00	2,730	4.10	4,660	5.40	7,800		

NOTE.—The above table is based on discharge measurements made during 1904-1906, and is well defined below gage height 10 feet. Above gage height 7 feet the rating curve is a tangent, the difference being 320 per tenth.

Monthly discharge of Tallapoosa River at Sturdevant, Ala., for 1906.

[Drainage area, 2,500 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	29,600	2,730	6,770	2.71	3.12
February	4,060	2,370	3,020	1.21	1.26
March	50,100	2,440	12,700	5.08	5.86
April	7,800	2,660	4,010	1.60	1.78
May	11,400	1,910	3,160	1.26	1.45
June	16,500	1,460	3,230	1.29	1.44
July	17,200	1,460	6,140	2.46	2.84
August	20,000	2,440	5,310	2.12	2.44
September	19,100	2,300	5,540	2.22	2.48
October	20,000	2,300	6,140	2.46	2.84
November	20,700	2,170	4,000	1.60	1.78
December	21,000	2,440	4,660	1.86	2.14
The year	59,100	1,460	5,390	2.16	29.43

NOTE.—Values for 1906 are excellent.

TALLAPOOSA RIVER SURVEY.

In order to point out the power possibilities along the Tallapoosa River, a profile has been prepared showing the fall between Tallaposa, Ga., and Matilda, Ala. In connection with this profile, notes showing tributary streams and other prominent natural and artificial features along the river are indicated.

Sheets showing this profile may be obtained upon application to the Director of the Geological Survey.

Some of the water-power plants on Tallapoosa River are shown on Pls. IV and V.

CAHABA RIVER AT CENTERVILLE, ALA.

This station was established August 7, 1901, and is situated at the iron highway bridge one-fourth mile west of Centerville, Ala., one-half mile above the Mobile and Ohio Railroad bridge. The gage was read during 1906 by Mrs. W. C. Edmonds. The conditions at this

station and the bench marks are described in Water-Supply Paper No. 168, page 134, where are given also references to publications that contain data for previous years.

Discharge measurements of Cahaba River at Centerville, Ala., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 4	W. E. Hall	150	656	3.35	779
June 25	F. A. Murray	125	399	1.60	280
October 25	W. E. Hall	154	646	3.26	686

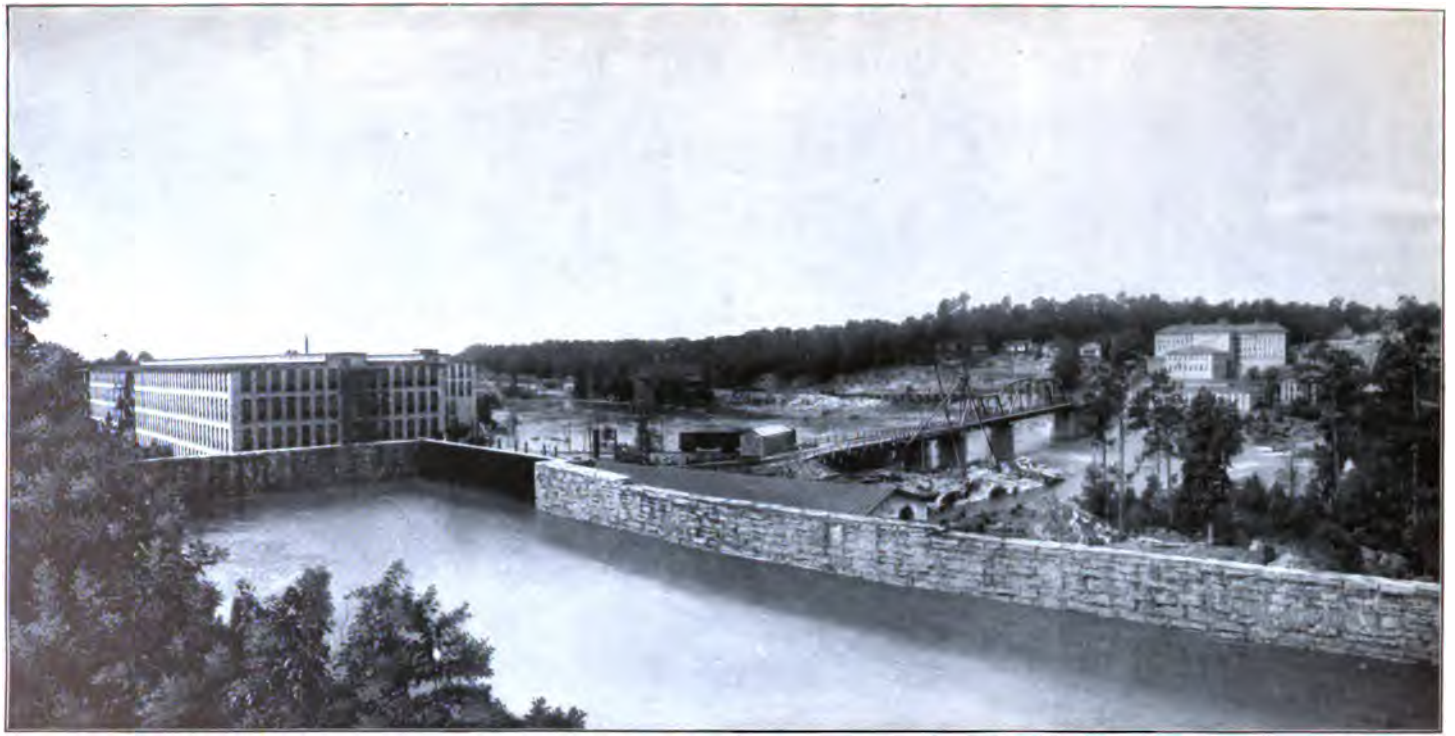
Daily gage height, in feet, of Cahaba River at Centerville, Ala., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.1	4.0	4.7	18.7	2.8	2.2	1.9	4.2	3.0	22.9	2.8	2.9
2	3.9	3.5	3.9	13.5	2.8	2.2	2.3	3.4	2.8	21.2	2.7	2.8
3	12.3	3.3	18.2	10.7	2.8	2.3	3.0	3.2	2.7	21.3	2.6	2.8
4	20.9	3.1	20.4	8.7	3.2	2.4	2.2	3.4	2.6	16.2	2.5	2.7
5	17.5	3.0	16.3	7.8	7.6	2.2	1.7	3.2	2.5	10.8	2.7	2.8
6	12.8	2.9	9.7	7.1	5.3	2.3	1.6	2.8	2.1	21.6	2.7	2.8
7	7.6	2.9	6.9	6.5	5.8	2.2	1.6	3.2	2.4	17.8	2.6	2.9
8	6.1	2.9	8.0	5.9	7.8	2.3	1.6	3.0	2.6	12.5	2.6	2.7
9	5.8	2.8	8.1	5.8	5.9	2.1	1.9	2.8	3.2	9.4	2.6	2.9
10	5.3	2.8	6.7	6.3	4.2	2.0	4.4	2.4	2.8	7.4	2.5	3.0
11	4.8	2.6	5.7	6.5	3.7	1.9	3.4	2.6	3.5	6.3	2.4	5.6
12	5.2	2.5	5.5	5.4	3.4	1.8	3.9	4.4	5.0	5.6	2.5	7.2
13	5.7	2.5	4.7	4.9	3.2	1.7	2.9	3.4	5.5	5.1	2.5	5.2
14	5.2	2.7	4.5	4.6	3.0	2.0	10.0	4.2	6.2	4.6	2.4	4.4
15	4.9	2.9	5.3	4.4	2.9	3.0	8.1	5.1	4.8	4.4	2.9	4.0
16	4.5	2.6	5.0	4.3	2.8	2.8	5.7	4.6	3.0	4.1	2.9	3.6
17	4.2	2.5	4.6	4.1	2.7	2.6	5.5	3.6	2.5	4.0	2.7	3.9
18	4.2	2.4	4.1	3.9	2.6	2.4	11.7	3.1	2.3	4.1	3.1	5.0
19	4.2	2.3	33.8	3.8	2.7	2.2	15.8	2.6	2.1	4.6	9.6	4.9
20	4.3	2.2	30.8	3.7	2.6	2.0	10.7	2.4	2.3	4.8	9.8	4.8
21	4.0	2.4	27.0	3.6	2.5	1.9	6.1	2.2	3.6	4.0	6.3	4.7
22	4.7	2.5	19.5	3.9	2.5	1.8	5.0	2.4	3.8	3.7	5.1	4.5
23	17.0	2.6	14.6	3.7	2.5	1.7	8.4	2.8	3.5	3.5	4.3	4.2
24	16.0	2.7	10.0	3.5	2.5	1.6	9.6	2.2	3.3	3.3	3.9	3.9
25	10.4	6.6	8.4	3.4	2.7	1.6	5.7	2.0	3.7	3.2	3.7	3.7
26	7.4	5.6	7.4	3.3	2.7	1.6	4.2	2.4	3.4	3.1	3.3	3.5
27	6.1	5.2	6.9	3.1	2.8	2.6	3.5	1.9	3.1	3.1	3.2	3.5
28	5.2	4.6	24.6	3.0	2.6	3.5	3.1	3.2	20.7	3.0	3.2	3.9
29	4.7	.....	24.5	3.0	2.5	2.9	4.3	2.5	33.7	2.8	3.0	6.5
30	4.0	.....	26.5	2.9	2.4	2.2	6.9	3.2	29.6	2.8	3.0	5.9
31	4.1	.....	23.4	.....	2.3	.....	5.3	2.4	.....	2.9	.....	20.0

Rating table for Cahaba River at Centerville, Ala., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.60	280	2.80	583	4.00	960	5.40	1,604
1.70	301	2.90	611	4.10	1,030	5.60	1,698
1.80	323	3.00	640	4.20	1,072	5.80	1,794
1.90	346	3.10	670	4.30	1,114	6.00	1,890
2.00	370	3.20	701	4.40	1,156	6.20	1,990
2.10	395	3.30	733	4.50	1,200	6.40	2,090
2.20	421	3.40	766	4.60	1,244	6.60	2,192
2.30	447	3.50	800	4.70	1,288	6.80	2,296
2.40	473	3.60	836	4.80	1,332	7.00	2,400
2.50	500	3.70	874	4.90	1,376	8.00	2,950
2.60	527	3.80	912	5.00	1,420	9.00	3,500
2.70	555	3.90	950	5.20	1,512	10.00	4,050

NOTE.—The above table is based on three discharge measurements made during 1906 and on the forms of previous curves. It is not well defined. Above gage height 7 feet it is a tangent, the difference being 55 per tenth.



CANAL, POWER HOUSE, AND MILLS OF TALLASSEE FALLS MANUFACTURING COMPANY ON TALLAPOOSA RIVER AT TALLASSEE, ALA.

Monthly discharge of Cahaba River at Centerville, Ala., for 1906.

[Drainage area, 1,040 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	10,000	950	2,680	2.58	2.97
February	2,190	421	735	.707	.74
March	1,100	950	5,690	5.47	6.31
April	8,840	611	1,850	1.78	1.99
May	2,840	447	847	.814	.94
June	800	280	426	.410	.46
July	7,240	280	1,740	1.67	1.92
August	1,470	346	683	.657	.76
September	17,100	395	2,080	2.00	2.23
October	11,100	583	3,070	2.95	3.40
November	3,940	473	913	.878	.98
December	9,550	555	1,330	1.28	1.48
The year	17,100	280	1,840	1.77	24.18

NOTE.—Values for 1906 are good.

TOMBIGBEE RIVER AT COLUMBUS, MISS.

This station is located at the county highway bridge at the south end of Main street, in the city of Columbus, Miss. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 137, where are given also references to publications that contain data for previous years.

Discharge measurements of Tombigbee River at Columbus, Miss., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 21	F. A. Murray	127	1,230	−0.64	2,040
April 23	do	125	1,210	− .82	1,910
April 26	do	119	1,170	−1.10	1,680
May 3	W. E. Hall	109	1,190	−1.38	1,590
September 18	M. R. Hall	72	876	−3.40	424

Daily gage height, in feet, of Tombigbee River at Columbus, Miss., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.7	1.5	3.3	18.2	−1.3	−2.3	−3.3	−2.6	−3.2	6.8	−2.3	−0.4
2	3.3	.9	2.8	18.2	−1.4	−2.4	−3.2	−2.3	−3.4	7.7	−2.4	− .5
3	5.4	.3	4.0	17.3	−1.6	−2.2	−3.3	−2.2	−3.4	8.3	−2.5	− .9
4	9.6	− .1	4.4	15.6	− .9	−1.1	−3.4	−2.1	−3.4	8.2	−2.5	−1.2
5	11.0	− .3	4.4	13.0	+6.9	− .6	−3.4	−2.3	−3.5	7.6	−2.6	−1.3
6	9.9	− .6	4.7	9.2	8.0	− .9	−3.3	−2.7	−3.5	11.2	−2.6	−1.2
7	10.3	− .7	4.6	6.0	8.9	−1.6	−3.4	−2.9	−3.5	12.3	−2.6	−1.1
8	10.4	− .8	4.0	4.0	9.6	−1.9	−3.5	−3.2	−3.0	11.1	−2.6	− .6
9	9.0	− .9	2.9	2.8	8.9	−2.2	−3.5	−3.2	−2.8	9.0	−2.7	− .5
10	7.2	−1.0	2.0	2.1	7.8	−2.3	−3.5	−3.2	−3.1	9.2	−2.7	+ .2
11	5.2	−1.1	1.4	1.7	6.3	−2.5	−3.5	−3.2	−3.3	8.1	−2.7	2.7
12	4.8	−1.2	.9	1.5	4.5	−2.7	−3.5	−2.8	−3.3	6.0	−2.7	2.6
13	4.6	−1.2	.3	1.2	2.3	−2.9	−3.5	−2.6	−3.3	3.3	−2.7	1.5
14	4.2	−1.1	− .1	.9	− .1	−3.0	−3.2	−2.7	−3.4	1.5	−2.7	1.4
15	3.8	−1.1	+5.2	.7	−1.0	−2.6	−2.9	−2.5	−3.5	.4	−2.6	1.4
16	3.3	− .9	9.1	.6	−1.3	−1.3	−2.7	−1.5	−3.5	− .5	−2.5	1.3
17	2.4	− .9	9.9	.7	−1.5	−1.2	− .9	−1.8	−3.5	−1.1	−2.4	1.3
18	2.0	−1.0	10.3	.5	−1.7	−2.0	+2.0	−1.7	−3.4	−1.4	−1.3	4.6
19	2.3	−1.1	13.0	.1	−2.0	−2.3	3.7	−1.8	−3.4	−1.0	+2.1	5.5
20	1.9	−1.2	16.8	− .5	−1.9	−2.8	3.2	−2.2	−3.4	− .2	6.1	5.8
21	1.7	−1.3	16.6	− .7	−2.1	−3.0	2.3	−2.6	−3.4	+ .3	6.5	6.0
22	2.9	−1.2	15.7	− .8	−2.2	−3.1	1.3	−2.4	−3.2	.6	6.8	5.3
23	6.4	− .9	14.5	− .9	−2.2	−3.3	.8	−2.3	−2.4	.1	7.1	5.0
24	6.6	− .3	12.6	− .8	−2.3	−3.3	.4	−2.7	−1.6	− .3	6.6	4.3
25	6.7	+2.4	9.4	− .8	−2.0	−3.3	− .6	−3.0	−1.0	− .7	5.7	3.3

Daily gage height, in feet, of Tombigbee River at Columbus, Miss., for 1906—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26	7.1	3.5	5.8	−1.0	−2.1	−3.3	−1.3	−2.9	−.6	−.9	4.2	2.3
27	7.0	3.4	4.3	−1.3	−1.9	−3.3	−1.6	−3.0	−.3	−1.1	3.2	1.4
28	6.0	3.8	12.1	−1.4	−1.3	−3.2	−2.2	−3.2	+3.6	−1.5	2.1	.5
29	4.8	.....	14.0	.0	−1.8	−3.2	−2.4	−3.0	8.5	−1.8	1.2	.2
30	3.5	.....	16.0	−1.0	−1.9	−3.2	−2.6	−3.1	7.3	−2.1	.1	.1
31	2.5	.....	17.7	.....	−2.1	.....	−2.8	−3.2	.....	−2.3	.....	4.3

Rating table for Tombigbee River at Columbus, Miss., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
−3.50	340	−1.80	1,260	−.10	2,495	4.00	6,920
−3.40	380	−1.70	1,325	.00	2,580	5.00	8,240
−3.30	425	−1.60	1,390	.20	2,755	6.00	9,620
−3.20	470	−1.50	1,455	.40	2,935	7.00	11,060
−3.10	520	−1.40	1,520	.60	3,115	8.00	12,540
−3.00	570	−1.30	1,590	.80	3,305	9.00	14,040
−2.90	620	−1.20	1,660	1.00	3,500	10.00	15,590
−2.80	675	−1.10	1,730	1.20	3,700	11.00	17,170
−2.70	730	−1.00	1,800	1.40	3,900	12.00	18,800
−2.60	785	−.90	1,870	1.60	4,110	13.00	20,500
−2.50	840	−.80	1,940	1.80	4,320	14.00	22,200
−2.40	895	−.70	2,015	2.00	4,540	15.00	23,900
−2.30	950	−.60	2,090	2.20	4,760	16.00	25,600
−2.20	1,010	−.50	2,170	2.40	4,990	17.00	27,300
−2.10	1,070	−.40	2,250	2.60	5,220	18.00	29,000
−2.00	1,130	−.30	2,330	2.80	5,450		
−1.90	1,195	−.20	2,410	3.00	5,680		

NOTE.—The above table is based on five discharge measurements made during 1906, and on ten high-water measurements made before 1906. It is well defined below gage height 0.0 feet. Above gage height 12 feet the rating curve is a tangent, the difference being 170 per tenth.

Monthly discharge of Tombigbee River at Columbus, Miss., for 1906.

[Drainage area, 4,440 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	17,200	4,220	9,090	2.05	2.36
February	6,640	1,590	2,630	.592	.62
March	28,500	2,500	12,900	2.91	3.36
April	29,300	1,520	7,480	1.68	1.87
May	15,000	950	4,220	.950	1.10
June	2,090	425	909	.205	.23
July	6,540	340	1,580	.356	.41
August	1,460	470	790	.178	.21
September	13,300	340	1,630	.367	.41
October	19,300	950	6,800	1.53	1.76
November	11,200	730	3,520	.793	.88
December	9,620	1,590	4,520	1.02	1.18
The year	29,300	340	4,670	1.05	14.39

NOTE.—Values are rated as follows: June and August, good; remainder of 1906, excellent.

TOMBIGBEE RIVER AT EPES, ALA.

This station was established November 29, 1904. It is located at the bridge of the Alabama Great Southern Railway, one-half mile from Epes, Ala. The conditions at this station and the bench marks

are described in Water-Supply Paper No. 168, page 139, where are given also references to publications that contain data for previous years.

Discharge measurements of Tombigbee River at Epes, Ala., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
September 24	M. R. Hall	125	786	1.39	1,290
October 27	W. E. Hall	175	1,300	4.03	3,190

Daily gage height, in feet, of Tombigbee River at Epes, Ala., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	11.2	14.1	12.7	39.9	4.45	2.95	1.4	4.3	1.1	21.0	2.55	5.7
2	11.0	11.6	11.6	39.9	3.75	2.7	1.2	2.95	1.05	22.5	2.85	5.2
3	13.2	9.5	13.1	40.2	3.85	2.45	1.0	2.65	0.95	24.0	2.2	4.9
4	18.6	8.0	12.9	40.4	4.6	2.3	0.95	2.2	.9	24.4	2.2	4.15
5	21.4	7.2	13.2	40.5	6.7	2.7	.95	3.1	.9	25.1	2.1	3.75
6	22.4	6.4	12.6	40.2	12.4	3.15	.95	2.9	.8	26.2	2.0	3.7
7	21.9	5.8	12.4	39.1	17.2	3.3	.95	2.65	.6	31.4	1.9	3.6
8	21.3	5.3	12.6	36.8	19.2	3.0	.95	2.15	.6	33.1	1.9	3.65
9	21.0	5.0	11.8	32.6	20.0	2.65	.95	1.65	.55	33.2	1.85	3.9
10	20.4	4.7	10.3	27.0	19.2	2.45	1.1	1.4	.8	32.6	1.8	5.4
11	18.4	4.5	9.2	22.2	17.5	2.25	1.1	1.5	1.35	31.0	1.75	8.6
12	15.6	4.3	8.2	18.2	15.3	2.05	1.35	1.45	1.25	29.1	1.7	11.2
13	13.6	4.2	7.6	14.5	12.6	1.85	1.4	1.8	1.1	25.9	1.7	11.6
14	12.9	4.2	7.2	12.0	9.2	1.8	1.9	2.15	1.1	21.2	1.7	9.9
15	12.0	4.1	6.8	8.8	6.6	1.65	5.8	2.65	1.0	15.1	1.65	8.7
16	11.2	4.2	9.7	7.6	4.95	1.6	4.7	2.35	.9	10.7	1.55	8.3
17	10.2	4.35	14.2	7.1	4.2	2.15	4.3	2.55	.8	6.8	1.45	8.2
18	9.3	4.4	17.0	6.8	3.7	2.85	10.2	2.7	.8	5.8	1.85	10.4
19	8.6	4.35	35.1	6.5	3.45	2.6	14.4	2.5	.8	5.0	3.0	12.0
20	8.4	4.15	39.8	6.0	3.15	2.1	12.8	2.45	.8	4.5	6.2	12.6
21	8.4	4.25	41.2	6.2	2.9	1.8	11.4	2.3	.8	4.9	9.8	12.8
22	18.0	4.4	41.6	5.3	2.9	1.55	9.4	1.95	.7	5.3	11.8	12.8
23	22.3	4.4	41.7	4.9	2.6	1.35	7.5	1.8	.7	5.5	13.0	12.4
24	21.3	5.6	41.6	4.75	2.65	1.2	6.4	1.65	1.45	5.4	13.4	11.6
25	21.2	9.4	41.3	4.55	2.7	1.2	5.8	1.7	2.55	5.0	13.2	10.6
26	20.6	10.7	40.6	4.4	2.75	1.75	4.65	1.5	3.35	4.4	12.2	9.6
27	20.0	12.4	38.4	4.2	3.2	2.65	3.7	1.25	4.9	4.0	11.1	8.6
28	19.6	12.8	38.6	3.85	3.65	2.1	3.1	1.15	12.7	3.6	8.9	7.8
29	18.6	.....	38.7	3.8	3.75	1.75	2.85	1.05	17.6	3.3	8.0	7.2
30	17.2	.....	39.2	3.9	3.55	1.45	4.45	1.1	19.5	3.0	7.0	7.7
31	15.3	.....	39.7	.....	3.3	.....	5.5	1.15	.....	2.75	.....	16.2

Rating table for Tombigbee River at Epes, Ala., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.50	770	1.80	1,480	3.10	2,370	4.80	3,870
0.60	810	1.90	1,540	3.20	2,450	5.00	4,060
0.70	850	2.00	1,600	3.30	2,530	5.20	4,250
0.80	900	2.10	1,660	3.40	2,610	5.40	4,450
0.90	950	2.20	1,725	3.50	2,690	5.60	4,652
1.00	1,000	2.30	1,790	3.60	2,780	5.80	4,856
1.10	1,060	2.40	1,855	3.70	2,870	6.00	5,060
1.20	1,120	2.50	1,925	3.80	2,960	6.20	5,268
1.30	1,180	2.60	1,995	3.90	3,050	6.40	5,476
1.40	1,240	2.70	2,065	4.00	3,140	6.60	5,684
1.50	1,300	2.80	2,140	4.20	3,320	6.80	5,892
1.60	1,360	2.90	2,215	4.40	3,500	7.00	6,100
1.70	1,420	3.00	2,290	4.60	3,680		

NOTE.—The above table is based on nine discharge measurements made during 1904-1906, and is well defined between gage heights 0.9 feet and 15.6 feet. Above gage height 6 feet the rating curve is a tangent, the difference being 104 per tenth.

Monthly discharge of Tombigbee River at Epes, Ala., for 1906.

[Drainage area, 8,830 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	22,100	7,560	15,800	1.79	2.06
February	13,500	3,230	5,720	.648	.67
March	42,200	5,890	23,000	2.60	3.00
April	40,900	2,960	17,300	1.96	2.19
May	19,600	2,000	6,570	.744	.86
June	2,530	1,120	1,730	.196	.22
July	13,800	975	3,810	.432	.50
August	3,410	1,030	1,680	.190	.22
September	19,100	790	2,660	.301	.34
October	33,300	2,100	14,900	1.69	1.95
November	12,800	1,270	4,550	.515	.57
December	15,700	2,780	7,670	.869	1.00
The year	42,200	790	8,780	.995	13.58

NOTE.—Values for 1906 are excellent.

BLACK WARRIOR RIVER NEAR CORDOVA, ALA.

This station is located at the Kansas City, Memphis and Birmingham Railroad bridge, which crosses the river below the junction of Mulberry and Sipsey forks and about three-fourths mile from Cordova, Ala. The gage was established by the United States Weather Bureau. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 142, where are given also references to publications that contain data for previous years.

Discharge measurements of Black Warrior River near Cordova, Ala., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 20	F. A. Murray	170	1,210	1.05	1,440
April 27	do	168	1,120	0.71	1,080
June 22	do	165	967	−0.28	333
June 23	do	180	573	−0.33	264

Daily gage height, in feet, of Black Warrior River near Cordova, Ala., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.4	2.7	1.9	14.2	0.4	1.1	−.6	0.6	0.1	13.0	0.1	0.6
2	3.0	2.4	1.6	9.8	.45	.8	−.6	.45	1.1	17.0	.0	.6
3	6.9	2.1	8.0	7.2	.4	.65	−.6	.2	1.0	12.0	.0	.55
4	14.0	1.85	14.6	5.6	.8	.9	−.65	.1	.9	9.4	.0	.5
5	11.0	1.6	8.7	4.3	2.4	1.1	−.65	.1	1.1	6.1	.05	.4
6	6.8	1.5	6.8	3.8	2.2	.9	−.65	.0	1.0	8.6	.05	.6
7	5.3	1.4	5.7	3.4	2.0	.7	−.65	.0	1.0	13.9	.05	.9
8	4.6	1.3	4.4	3.1	1.6	.5	−.6	.1	.9	9.5	.05	.7
9	4.6	1.2	3.8	2.9	1.1	.4	−.6	−.1	.8	6.4	.1	.6
10	4.3	1.15	3.3	2.85	.8	.4	−.5	−.1	.6	3.8	.1	.7
11	4.0	1.0	2.6	2.8	.5	.35	−.4	−.2	.4	2.9	.05	1.5
12	4.6	.9	2.15	2.5	.3	.3	−.5	3.1	.3	2.2	.05	1.5
13	5.6	.9	2.1	2.3	.3	.2	−.6	3.4	.2	1.0	.05	1.4
14	4.8	1.0	2.0	2.1	.25	.15	+5.7	3.6	.5	1.2	.0	1.3
15	4.6	1.05	22.0	2.1	.2	.2	6.6	3.9	.4	1.0	.02	1.2

Daily gage height, in feet, of Black Warrior River near Cordova, Ala., for 1906—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	3.8	1.0	24.0	1.9	.1	.6	4.6	2.8	.0	.8	.05	1.1
17	3.2	1.0	14.3	1.8	.0	.4	2.6	1.7	− .2	.7	.05	1.0
18	3.0	.85	8.5	1.65	.0	.2	9.8	1.1	− .3	.9	.5	1.8
19	2.8	.7	15.5	1.4	− .05	.1	6.7	.9	.0	3.8	3.4	1.5
20	2.65	.6	22.7	1.2	− .1	.0	3.6	.6	+ .1	3.2	7.2	2.7
21	2.9	1.3	15.2	1.0	.0	− .25	3.2	.4	.3	2.1	4.7	2.3
22	18.5	2.0	8.0	1.2	+ .2	− .3	2.0	.2	.4	1.5	3.2	2.0
23	34.2	2.0	7.6	1.5	.4	− .4	1.6	.1	1.8	1.2	2.8	1.7
24	27.9	1.9	6.0	1.2	.5	− .4	3.2	.1	1.2	1.0	2.0	1.5
25	14.6	4.1	5.2	1.0	.8	− .55	2.3	.0	.7	.7	1.5	1.2
26	9.4	3.2	4.0	0.85	4.2	− .5	1.5	− .1	.6	.5	1.2	1.0
27	6.2	2.5	5.6	.7	3.9	− .4	1.0	− .1	.9	.3	1.1	.9
28	5.1	2.6	24.5	.5	3.1	− .5	.6	.9	1.2	.3	1.0	1.7
29	4.2	.....	19.5	.5	2.6	− .6	.6	2.1	17.0	.3	.9	2.6
30	3.6	.....	21.1	.45	2.2	− .5	1.5	1.0	20.5	.2	.7	3.1
31	3.0	.....	21.5	.....	1.7	.....	1.1	.4	.....	.2	.....	14.5

Rating table for Black Warrior River near Cordova, Ala., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
−0.70	110	0.80	1,170	2.30	2,715	4.60	5,560
−0.60	145	0.90	1,265	2.40	2,830	4.80	5,820
−0.50	190	1.00	1,360	2.50	2,945	5.00	6,080
−0.40	240	1.10	1,455	2.60	3,060	5.20	6,340
−0.30	300	1.20	1,550	2.70	3,175	5.40	6,600
−0.20	365	1.30	1,650	2.80	3,290	5.60	6,870
−0.10	430	1.40	1,750	2.90	3,405	5.80	7,150
0.00	500	1.50	1,850	3.00	3,525	6.00	7,430
0.10	575	1.60	1,955	3.20	3,765	7.00	8,830
0.20	650	1.70	2,060	3.40	4,005	8.00	10,230
0.30	730	1.80	2,165	3.60	4,260	9.00	11,650
0.40	810	1.90	2,270	3.80	4,520	10.00	13,150
0.50	895	2.00	2,380	4.00	4,780	11.00	14,650
0.60	985	2.10	2,490	4.20	5,040		
0.70	1,075	2.20	2,600	4.40	5,300		

NOTE.—The above table is based on discharge measurements made during 1900-1906 and is well defined below gage height 14 feet. Above gage height 8.8 feet it is a tangent, the difference being 150 per tenth.

Monthly discharge of Black Warrior River near Cordova, Ala., for 1906.

[Drainage area, 1,900 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	49,400	3,120	9,860	5.19	5.98
February	4,910	985	2,040	1.07	1.11
March	34,900	1,960	13,700	7.21	8.31
April	19,400	852	3,620	1.91	2.13
May	5,040	430	1,530	.805	.93
June	1,460	145	680	.358	.40
July	12,800	128	2,400	1.26	1.45
August	4,650	365	1,350	.71	.82
September	28,900	300	2,700	1.42	1.58
October	23,600	650	5,360	2.84	3.27
November	9,110	500	1,560	.821	.92
December	19,900	810	2,270	1.19	1.37
The year	49,400	128	3,930	2.07	28.27

NOTE.—Values are rated as follows: June, good; remainder of 1906, excellent.

MISCELLANEOUS MEASUREMENTS IN MOBILE RIVER DRAINAGE BASIN.

The following is a list of miscellaneous discharge measurements made in Mobile River drainage basin during 1906:

Etowah River near Canton, Ga.—A measurement was made February 23, 1906, at Field's bridge, a single-span iron highway bridge, 6 miles downstream from Canton, Ga. The bench mark is a chisel cut on the right side of the intermediate post, 145 feet from the right end of the bridge, downstream side; elevation, 36 feet above the datum of the assumed gage.

Width, 132 feet; area, 613 square feet; gage height, 4.94 feet; discharge, 1,290 second-feet.

Little River near Toonigh, Ga.—Measurements were made from a boat at a point about 300 feet downstream from Little River Mills. The bench mark is a nail in a willow tree which stands on right bank about 50 feet below the old rope ferry landing; elevation, 5 feet above the datum of the assumed gage.

February 23: Width, 40 feet; area, 76 square feet; gage height, 3.00 feet; discharge, 143 second-feet.

February 24: Width, 40 feet; area, 74 square feet; gage height, 2.97 feet; discharge, 133 second-feet.

Toonigh Creek near Toonigh, Ga.—A measurement was made February 24, 1906, from the foot plank at a point about 150 feet above the mouth of the creek. The bench mark is a nail driven into the water side of an ash tree on the right bank at the mouth of the creek; elevation, 9 feet above the datum of the assumed gage.

Width, 7.5 feet; area, 5.1 square feet; gage height, 1.42 feet; discharge, 8.8 second-feet.

Noonday Creek near Toonigh, Ga.—A measurement was made February 24, 1906, from the foot log, about one-fourth mile above the mouth of the creek. The bench mark is a nail driven into the water side of a 3-pronged ironwood tree on the right bank about 70 feet below the foot log; elevation, 4.60 feet above the datum of the assumed gage.

Width, 22 feet; area, 40 square feet; gage height, 2.60 feet; discharge, 58 second-feet.

Big Cedar Creek near Cavespring, Ga.—This stream enters Coosa River 6 miles northwest of Cavespring. A measurement was made May 14, 1906, at the bridge, 2½ miles northeast of Cavespring. The bench mark is the top of the second iron floor beam from the right end of the bridge, upstream side; elevation, 17 feet above the datum of the assumed gage.

Width, 77 feet; area, 230 square feet; gage height, 3.32 feet; discharge, 124 second-feet.

A measurement was made May 14, 1906, from a single-span iron wagon bridge, 3 miles north of Cavespring, near Wetsels Ford. The bench mark is the top of the upstream end of the second cross beam from the right end of the bridge; elevation, 20 feet above the datum of the assumed gage.

Width, 61 feet; area, 239 square feet; gage height, 2.92 feet; discharge, 161 second-feet.

Little Cedar Creek at Cavespring, Ga.—A measurement was made May 14, 1906, at a single-span iron footbridge on the road to the Cave Spring on the main street of the city. The bench mark is the top of the downstream end of the first iron cross beam from the right end of the bridge; elevation, 8 feet above the datum of the assumed gage.

Width, 32 feet; area, 14.7 square feet; gage height, 1.26 feet; discharge, 21.7 second-feet.

A measurement was made May 14, 1906, at a wagon bridge one-fourth mile north of Cavespring, Ga. The bench mark is the top of the downstream end of the first cross beam from the left end of the bridge; elevation, 7 feet above the datum of the assumed gage.

Width, 31 feet; area, 15 square feet; gage height, 1.01 feet; discharge, 31 second-feet.

Cave Spring near Cavespring, Ga.—A measurement was made May 14, 1906, at the footbridge, about 15 feet from the spring.

Width, 16 feet; area, 7 square feet; discharge, 4.5 second feet.

Tallapoosa River near Tallapoosa, Ga.—A measurement was made June 29, 1906, at Buchanan Bridge, about 4 miles north of Tallapoosa, Ga. The bench mark is the top of the downstream end of the center floor beam, the third from either end; elevation, 25.25 feet above the datum of the assumed gage.

Width, 41 feet; area, 101 square feet; gage height, 1.09 feet; discharge, 97 second-feet.

A measurement was made June 29, 1906, at Adderhold Bridge, about 2 miles north of Tallapoosa, Ga., and about 2 miles below Buchanan Bridge. The bench mark is the top of the downstream end of the first floor beam from the left bank; elevation, 22 feet above the datum of the assumed gage.

Width, 81 feet; area, 216 square feet; gage height, 0.93 feet; discharge, 146 second-feet.

Tallapoosa River near Heflin, Ala.—A measurement was made June 28, 1906, at Denman's wagon bridge, about 7 miles southwest of Heflin, Ala., on the road to Wedowee, Ala. The bench mark is the top of the downstream end of the cap beam of the center pile bent of the bridge; elevation, 24 feet above the datum of the assumed gage.

Width, 127 feet; area, 412 square feet; gage height, 2.90 feet; discharge, 452 second-feet.

Tallapoosa River at Luoina, Ala.—A measurement was made June 23, 1906, from the Louina highway bridge.

Width, 238 feet; area, 1,510 square feet; discharge, 1,300 second-feet.

Tallapoosa River near Dadeville, Ala.—A measurement was made June 21, 1906, from a ferryboat at Germany Ferry, 7 miles northeast of Dadeville, Ala. The Geodetic Survey bench mark was used in getting the elevation of water surface. It is located on the right bank of the river on a large water-oak tree; elevation, 22 feet above the datum of the assumed gage.

Width, 337 feet; area, 1,820 square feet; gage height, 5.63 feet; discharge, 1,780 second-feet.

A measurement was made June 20, 1906, from a ferryboat at Millers Ferry, 6 miles north of Dadeville, Ala. The bench mark is a spike driven into a water-oak tree on the east side of the road, 20 feet from the left bank of the river; elevation, 24 feet above the datum of the assumed gage.

Width, 357 feet; area, 4,370 square feet; gage height, 15 feet; discharge, 1,960 second-feet.

Highpine Creek at Liles Mill, Ala.—A measurement was made June 22, 1906, at a point about 150 feet below Liles Mill dam. The bench mark is a cut in the top of the bridge flooring just east of the first pier from the left bank; elevation, 16 feet above the datum of the assumed gage.

Width, 32 feet; area, 80 square feet; gage height, 2.90 feet; discharge, 67 second-feet.

Chickasanocsa Creek near Hampton, Ala.—A measurement was made June 22, 1906, by wading, at Leveretts Bridge, about 150 feet below the mill dam.

Width, 49 feet; area, 63 square feet; discharge, 54 second-feet.

Chattahaspee Creek near Hampton, Ala.—A measurement was made June 22, 1906, from Smiths Bridge, 1 mile west of the county line between Tallapoosa and Chambers counties. The bench mark is a cut in the top of the bridge flooring in the middle of the second crib from the left bank; elevation, 8 feet above the datum of the assumed gage.

Width, 34 feet; area, 171 square feet; gage height, 4.50 feet; discharge, 66 second-feet.

Emuckfaw Creek at Hamlet, Ala.—A measurement was made June 21, 1906, by wading, near Hamlet's mill. The bench mark is the top of the cap of the second pier from the west side of the bridge; elevation, 18 feet above the datum of the assumed gage.

Width, 35 feet; area, 29 square feet; gage height, 1.20 feet; discharge, 65 second-feet.

Sandy Creek near Camphill, Ala.—A measurement was made June 26, 1906, from a foot log about 1 mile above the forks of the creek.

Width, 31 feet; area, 93 square feet; discharge, 23 second-feet.

Sandy Creek near Dadeville, Ala.—A measurement was made June 25, 1906, at Smiths Bridge.

Width, 97 feet; area, 93 square feet; discharge, 118 second-feet.

South Fork Sandy Creek near Camphill, Ala.—A measurement was made June 26, 1906, from a highway bridge near Bulger's mill. The bench mark is the top of the floor on the south side of the second pier from the south side of the creek; elevation, 8 feet above the datum of the assumed gage.

Width, 49 feet; area, 46 square feet; gage height, 1.50 feet; discharge, 47 second-feet.

Little Sandy Creek near Camphill, Ala.—A measurement was made June 26, 1906, at a highway bridge which crosses the creek just above the railroad bridge. The bench mark is the top of the cap of the first bent from the right bank of the river; elevation, 8 feet above the datum of the assumed gage.

Width, 27 feet; area, 51 square feet; gage height, 3.90 feet; discharge, 21 second-feet.

North Fork Sandy Creek near Dadeville, Ala.—A measurement was made June 26, 1906, by wading, about 150 feet below Duncan's bridge.

Width, 29 feet; area, 25 square feet; discharge, 25 second-feet.

Timbercut Creek near Dadeville, Ala.—A measurement was made June 20, 1906, at a foot log about 1 mile above the mouth of the creek at a ford on the road to Welch Ferry.

Width, 24 feet; area, 27 square feet; discharge, 22 second-feet.

Blue Creek at Susanna, Ala.—A measurement was made June 25, 1906, at the highway bridge.

Width, 27 feet; area, 40 square feet; discharge, 22 second-feet.

Wind Creek near Meltons Mill, Ala.—A measurement was made June 25, 1906, at Ledbetters Bridge. The creek was at a low stage.

Width, 13 feet; area, 11 square feet; discharge, 9 second-feet.

Sougahatchee Creek near Thaddeus, Ala.—A measurement was made June 25, 1906, from Loveladys Bridge. The bench mark is the top of the cap on the north side of the main bent, upstream side; elevation, 28 feet above the datum of the assumed gage.

Width, 77 feet; area, 107 square feet; gage height, 4.10 feet; discharge, 103 second-feet.

Buttahatchee River near Columbus, Miss.—A measurement was made April 26, 1906, at a covered wooden wagon bridge 15 miles north of Columbus, Miss., on the road to Aberdeen, Miss. The bench mark is the top of the upstream end of the second wooden crossbeam from the left bank wooden trestle pier; elevation, 23 feet above the datum of the assumed gage.

Width, 108 feet; area, 507 square feet; gage height, 6.76 feet; discharge, 587 second-feet.

Luxapelila Creek near Columbus, Miss.—A measurement was made April 23, 1906, at a single-span iron highway bridge at the Columbus waterworks. The bench mark is the top of the upstream end of the crossbeam 90 feet from the right end of the bridge; elevation, 26.45 feet above the datum of the assumed gage.

Width, 96 feet; area, 646 square feet; gage height, 3.20 feet; discharge, 312 second-feet.

Tibbee River near West Point, Miss.—A measurement was made April 26, 1906, at a single-span iron highway bridge 3 miles southwest of West Point and about 600 feet downstream from the Illinois Central Railroad bridge. The bench mark is the top of the upstream end of an iron crossbeam, 31 feet from the left end of the bridge; elevation, 28 feet above the datum of the assumed gage.

Width, 56 feet; area, 248 square feet; gage height, 5.94 feet; discharge, 227 second-feet.

A measurement was made April 24, 1906, from a single-span iron highway bridge 5 miles south of West Point, Miss., and about 500 feet above the Mobile and Ohio Railroad bridge. The bench mark is the top of the upstream end of the second iron crossbeam from the right end of the bridge; elevation, 32 feet above the datum of the assumed gage.

Width, 52 feet; area, 140 square feet; gage height, 4.88 feet; discharge, 238 second-feet.

Sahatonchee Creek near West Point, Miss.—A measurement was made April 24, 1906, from a two-span iron highway bridge 3 miles west of West Point, Miss. The bench mark is the top of the upstream end of an iron crossbeam 90 feet from the left end of the bridge; elevation, 25 feet above the datum of the assumed gage.

Width, 96 feet; area, 168 square feet; gage height, 3.48 feet; discharge, 125 second-feet.

Oaknoxubee River near Macon, Miss.—A measurement was made April 25, 1906, at a single-span iron highway bridge one-fourth mile south of Macon. The bench mark is the top of the upstream end of an iron cross-beam 68 feet from the left bank end of the hand rail; elevation, 37 feet above the datum of the assumed gage.

Width, 51 feet; area, 229 square feet; gage height, 6.42 feet; discharge, 173 second-feet.

PEARL RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Pearl River rises in the eastern part of Mississippi. It flows south into Lake Borgne, an arm of the Gulf of Mexico, forming part of the boundary between Louisiana and Mississippi.

PEARL RIVER AT JACKSON, MISS.

This station was established June 24, 1901. It is located at a highway bridge, 2 miles from the union station at Jackson, Miss., one-eighth mile above the Alabama and Vicksburg Railroad, and two blocks east from the end of the South State street car line. The conditions at this station and the bench marks are described in Water-Supply Paper No. 168, page 152, where are given also references to publications that contain data for previous years.

Discharge measurements of Pearl River at Jackson, Miss., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 20 [a]	W. E. Hall	891	7,010	23.47	9,120
May 1	do	119	579	3.24	898
September 21	M. R. Hall	106	381	1.66	429

[a] Discharge affected by backwater.

Daily gage height, in feet, of Pearl River at Jackson, Miss., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.4	10.0	4.8	28.8	3.2	6.3	2.3	2.1	1.0	21.3	3.0	3.5
2	6.7	8.8	5.4	28.4	3.3	6.8	2.4	2.0	1.0	21.6	2.8	3.4
3	9.2	7.9	5.7	27.8	3.3	6.8	2.2	2.0	1.0	21.6	2.7	3.2
4	11.8	7.2	5.9	27.1	4.7	6.7	2.0	2.5	1.0	21.7	2.6	2.9
5	11.5	6.8	6.2	26.6	8.1	6.6	1.9	2.9	2.1	23.4	2.5	2.7
6	11.3	6.4	6.2	26.0	9.7	6.0	1.8	3.3	1.2	26.4	2.4	2.5
7	10.4	5.9	6.1	25.4	12.6	5.4	1.7	3.6	1.4	27.6	2.3	2.4
8	10.8	5.4	6.0	24.8	14.9	4.9	1.7	3.7	2.4	28.3	2.2	2.3
9	10.7	4.7	5.9	23.4	15.5	4.1	1.7	3.7	2.8	28.6	2.1	2.3
10	10.6	4.3	5.8	21.9	15.9	3.6	1.7	3.6	3.2	29.0	2.1	2.4
11	10.7	4.2	5.6	20.1	15.7	3.1	2.6	3.5	3.2	29.6	2.0	3.5
12	11.1	3.8	5.4	18.5	15.3	2.8	2.7	3.3	3.0	30.0	1.9	2.8
13	11.0	3.7	5.0	15.4	14.9	2.6	2.9	2.9	3.1	30.1	1.9	4.1
14	10.6	3.6	4.8	13.2	14.7	2.5	2.3	2.2	3.2	29.8	1.9	5.8
15	10.1	3.5	4.5	9.8	14.0	2.4	2.2	2.1	2.8	29.3	1.9	7.0
16	9.4	3.3	4.1	8.9	12.7	2.3	2.1	2.1	2.2	28.4	1.9	8.1
17	9.2	3.3	3.7	8.1	10.9	2.2	2.4	2.0	1.9	27.4	1.8	8.5
18	9.0	3.3	3.9	7.6	8.9	2.1	3.9	1.9	1.8	26.2	1.9	8.2
19	8.7	3.3	17.9	7.1	7.6	2.2	3.5	1.9	1.8	24.6	2.3	7.4
20	8.3	3.3	23.2	6.7	6.5	2.2	3.7	1.8	1.7	23.1	2.3	7.1
21	7.9	3.2	24.9	6.1	6.0	2.1	4.3	1.7	1.7	20.0	2.2	7.0
22	10.1	3.2	25.2	6.6	5.2	2.0	4.4	1.7	1.7	16.5	2.2	7.0
23	12.6	3.2	25.0	5.1	4.5	1.9	4.6	1.6	1.7	11.1	2.6	6.9
24	13.2	4.0	25.2	4.7	4.1	1.8	4.3	1.5	1.8	7.5	3.2	6.8
25	14.1	4.6	26.4	4.4	3.8	1.8	4.0	1.4	2.0	6.0	3.5	6.7
26	14.5	3.8	27.2	4.0	3.5	1.7	3.6	2.5	2.2	5.1	3.7	6.5
27	14.1	4.0	27.8	3.8	3.6	2.0	3.3	2.0	4.1	4.5	3.8	6.2
28	12.1	4.4	29.0	3.5	3.6	1.8	3.0	1.4	16.4	4.0	3.8	5.9
29	11.6	.....	29.8	3.4	4.0	2.0	2.7	1.3	19.4	3.6	3.7	5.4
30	11.2	.....	29.6	3.3	4.7	2.4	2.4	1.2	20.8	3.4	3.6	5.6
31	10.8	.....	29.4	.....	5.7	.....	2.2	1.0	.....	3.1	.....	7.8

Rating table for Pearl River at Jackson, Miss., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	320	2.80	732	5.20	1,870	16.00	8,700
1.10	335	2.90	770	5.40	1,980	17.00	9,500
1.20	350	3.00	810	5.60	2,090	18.00	10,300
1.30	366	3.10	852	5.80	2,200	19.00	11,100
1.40	383	3.20	894	6.00	2,310	20.00	12,000
1.50	400	3.30	938	6.20	2,420	21.00	12,900
1.60	418	3.40	984	6.40	2,530	22.00	13,900
1.70	436	3.50	1,030	6.60	2,640	23.00	15,000
1.80	455	3.60	1,078	6.80	2,750	24.00	16,200
1.90	475	3.70	1,126	7.00	2,860	25.00	17,500
2.00	495	3.80	1,174	8.00	3,435	26.00	19,000
2.10	518	3.90	1,223	9.00	4,035	27.00	20,700
2.20	543	4.00	1,272	10.00	4,635	28.00	22,600
2.30	570	4.20	1,370	11.00	5,285	29.00	24,500
2.40	599	4.40	1,470	12.00	5,935	30.00	26,400
2.50	630	4.60	1,570	13.00	6,600		
2.60	662	4.80	1,670	14.00	7,300		
2.70	696	5.00	1,770	15.00	8,000		

NOTE.—The above table is based on discharge measurements made during 1903-1906 and is fairly well defined.

Monthly discharge of Pearl River at Jackson, Miss., for 1906.

[Drainage area, 3,120 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	7,650	2,530	5,090	1.63	1.88
February	4,640	894	1,690	.542	.56
March	26,000	1,130	9,520	3.05	3.52
April	24,100	938	8,940	2.87	3.20
May	8,630	894	3,910	1.25	1.44
June	2,750	436	1,130	.362	.40
July	1,570	436	788	.253	.29
August	1,130	320	616	.197	.23
September	12,700	320	1,620	.519	.58
October	26,600	852	14,400	4.62	5.33
November	1,170	455	686	.220	.25
December	3,740	570	1,960	.628	.72
The year	26,600	320	4,200	1.35	18.40

NOTE.—Values are rated as follows: March, April, and October, fair; remainder of the year excellent. There is liable to be gorging at this station for stages above about 15 feet. This probably does not always occur and usually lasts only a few days.

BOGUE CHITTO AT WARNERTON, LA.

On April 28, 1906, a station was established on this stream, located at the Kentwood and Eastern Railroad bridge, one-fourth mile west of Warnerton, La. The gage is a vertical rod attached to the bridge piling on the upstream side of the bridge, about 15 feet from the left bank. The gage was read for a short while only by J. W. Warner.

The current is moderately slow and is broken by the wooden piers and a number of trestle bents.

The bench mark is the top of the right bank end of the lower chord of the wooden truss, downstream side of the bridge; elevation, 23.00 feet above the datum of the gage.

A measurement was made April 27, 1906, by W. E. Hall, with the following results:

Width, 111 feet; area, 823 square feet; gage height, 2.90 feet; discharge, 571 second-feet.

Daily gage height, in feet, of Bogue Chitto River at Warnerton, La., for 1906.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1		2.9	4.9	2.7	17		2.7	2.8	3.6
2		2.9	4.4	2.7	18		2.7	2.8	3.4
3		2.8	4.2	2.8	19		2.7	2.8	3.2
4		2.8	3.9	2.8	20		2.7	2.7	3.1
5		2.8	3.7	2.9	21		2.7	2.7	3.0
6		2.8	3.5	3.0	22		2.7	2.7	3.0
7		2.8	3.2	3.1	23		3.8	2.8	2.9
8		2.8	3.0	3.0	24		4.6	2.8	2.9
9		2.8	3.0	2.9	25		4.9	2.9	2.8
10		2.8	2.9	2.9	26		5.2	2.9	2.8
11		2.8	2.8	2.8	27	2.9	5.2	2.8	2.7
12		2.7	2.8	2.8	28	2.9	5.9	2.8	2.7
13		2.7	2.8	2.7	29	3.0	5.8	2.7	2.7
14		2.7	2.8	2.7	30	3.0	5.7	2.7	2.7
15		2.7	2.8	2.9	31		5.3		2.7
16		2.7	2.8	3.2					

LAKE PONTCHARTRAIN DRAINAGE BASIN.

MISCELLANEOUS MEASUREMENTS.

The following is a list of miscellaneous discharge measurements made in Lake Pontchartrain drainage basin during 1906:

Tangipahoa River near Kentwood, La.—A measurement was made April 27, 1906, at the Kentwood and Eastern Railroad bridge. The bench mark is the top of the downstream end of the cap of the fourth bent from the right bank; elevation, 13 feet above the datum of the assumed gage.

Width, 88 feet; area, 310 square feet; gage height, 3.75 feet; discharge, 242 second-feet.

Tangipahoa River near Tangipahoa, La.—A measurement was made June 20, 1906, at a wooden highway bridge 1 mile east of Tangipahoa, La. The bench mark is the top of the downstream end of the right bent of the middle of a wooden pier; elevation, 15 feet above the datum of the assumed gage.

Width, 96 feet; area, 324 square feet; gage height, 3.60 feet; discharge, 242 second-feet.

Tangipahoa River near Amite, La.—A measurement was made April 25, 1906, from the steel wagon bridge 1 mile from Amite, La. The bench mark is the top of the outer eyebar of the lower chord on the upstream side of the bridge, at a point 1 foot to the right of the

first intermediate post from the right bank pier; elevation, 18 feet above the datum of the assumed gage.

Width, 133 feet; area, 470, square feet; gage height, 2.57 feet; discharge, 462 second-feet.

Tickfaw River near Montpelier, La.—A measurement was made April 26, 1906, at a wooden wagon bridge 1 mile east of Montpelier and about 9 miles west of Amite. The bench mark is the top of the downstream end of the cap of the second bent from the right end of the bridge; elevation, 14 feet above the datum of the assumed gage.

Width, 90 feet; area, 213 square feet; gage height, 2.65 feet; discharge, 155 second-feet.

INDEX.

A. Page.

Acknowledgments and cooperation..... 16
Acre-foot, definition of..... 4
Alabama River at—
Selma, Ala.:
description..... 75
discharge..... 76
discharge, monthly..... 77
gage heights..... 76
rating table..... 77
Albany, Ga.,
Flint River at:
description..... 61-62
discharge..... 62
discharge, monthly..... 63
gage heights..... 62
rating table..... 63
Alcovy River near—
Stewart, Ga.:
description..... 40
discharge..... 41
discharge, monthly..... 42
gage heights..... 41
rating table..... 41
Alston, S. C.,
Broad River (of the Carolinas) at:
description..... 22
discharge..... 22
discharge, monthly..... 23
gage heights..... 22-23
rating table..... 23
Altamaha River basin:
description of..... 36-37
Amite, La.,
Tangipahoa River near:
description..... 101-102
discharge..... 102
Anthony Shoals,
Broad River (of Georgia) at:
description..... 34
discharge..... 34
Apalachee River near—
Buckhead, Ga.:
description..... 42
discharge..... 42
discharge, monthly..... 43
gage heights..... 42-43
rating table..... 43
Apalachicola River basin:
description of..... 51-52
miscellaneous measurements in..... 67-68
Atlanta Water and Electric Power, plant of, view of..... 54

Page.

Atlanta, power plant near, view of..... 54
Augusta, Ga.,
Savannah River at:
description..... 30
discharge..... 30
discharge, monthly..... 31
gage heights..... 30-31
rating table..... 31

B.

Bainsbridge, Ga.,
Spring Creek near:
description..... 68
discharge..... 68
Beck, Ala.,
Conecuh River at:
description..... 73
discharge..... 73
discharge, monthly..... 74
gage heights..... 73-74
rating table..... 74
Big Cedar Creek near—
Cavespring, Ga.:
description..... 94
discharge..... 94
Big Potato Creek near—
Thomaston, Ga.:
description..... 67-68
discharge..... 68
Black Warrior River at and near—
Cordova, Ala.:
description..... 92
discharge..... 92
discharge, monthly..... 93
gage heights..... 92-93
rating table..... 93
Blue Creek at—
Susanna, Ala.:
discharge..... 97
Bogue Chitto at—
Warnerton, La.:
description..... 100
discharge..... 101
gage heights..... 101
Bolster, R. H., work of..... 1
Brantley, Ala.,
Conecuh River near:
description..... 75
drainage..... 75
Broad River (of Georgia) at—
Anthony Shoals:
description..... 34
discharge..... 34

Page.

Broad River (of Georgia) near—
Cariton, Ga.:
description 32
discharge 32
discharge, monthly 33
gage heights 32
rating table 33
Broad River (of the Carolinas) at—
Alston, S. C.:
description 22
discharge 22
discharge, monthly 23
gage heights 22–23
rating table 23
survey of 23
Buckhead, Ga.,
Apalachee River near:
description 42
discharge 42
discharge, monthly 43
gage heights 42–43
rating table 43
Bull Sluice, Ga., power plant at, view of 54
Buttahatchee River near—
Columbus, Miss.:
description 97
discharge 97

C.

Cable station, figure showing 11
Cahaba River at and near—
Centerville, Ala.:
description 87–88
discharge 88
discharge, monthly 89
gage heights 88
rating table 88
Camden, S. C.,
Wateree River near:
description 20
discharge 20
discharge, monthly 22
gage heights 21
rating table 21
Camphill, Ala.,
Little Sandy Creek near:
description 97
discharge 97
Sandy Creek near:
discharge 96
South Fork Sandy Creek near:
description 97
discharge 97
Cannoochee River near—
Groveland, Ga.:
description 34
discharge 34
discharge, monthly 36
gage heights 35
rating table 35
Canton, Ga.,
Etowah River near:
description 94
discharge 94

Page.

Cariton, Ga.,
Broad River (of Georgia) near:
description 32
discharge 32
discharge, monthly 33
gage heights 32
rating table 33
Carters, Ga.,
Coosawattee River at:
description 83
discharge 83
discharge, monthly 84
gage heights 83
rating table 83
Catawba River near—
Morganton, N. C.:
description 19
discharge 19
discharge, monthly 20
gage heights 19
rating table 19
survey 20
Cavespring, Ga.,
Big Cedar Creek near:
description 94, 95
discharge 94, 95
Cave Spring near:
description 95
discharge 95
Little Cedar Creek at:
description 95
discharge 95
Centerville, Ala.,
Cahaba River at:
description 87–88
discharge 88
discharge, monthly 89
gage heights 88
rating table 88
Chattahaspee Creek near—
Hampton, Ala.:
description 96
discharge 96
Chattahoochee River at or near—
Norcross, Ga.:
description 54
discharge 54
discharge, monthly 55
gage heights 54
rating table 55
Vinings, Ga.:
description 67
discharge 67
West Point, Ga.:
description 55
discharge 55
discharge, monthly 56
gage heights 56
rating table 56
power plants on, views of 54
Chauga River near—
Madison, S. C.:
description 33
discharge 33

Page.
Chickasanocsa Creek near—
Hampton, Ala.:
description 96
discharge 96
Choccolocco Creek near—
Jenifer, Ala.:
description 84
discharge 84
discharge, monthly 85
gage heights 84-85
rating table 85
Choctawhatchee River near—
Newton, Ala.:
description 68-69
discharge 69
gage heights 69
rating table 69
Choctawhatchee River basin:
description of 68
miscellaneous measurements in 72-73
Columbus, Miss.,
Buttahatchee Creek near:
description 97
discharge 97
Luxapellila Creek at:
description 98
discharge 98
Tombigbee River at:
description 89
discharge 89
discharge, monthly 90
gage heights 89-90
rating table 90
Computation, methods of 13-16
Conecuh River at—
Beck, Ala.:
description 73
discharge 73
discharge, monthly 74
gage heights 73-74
rating table 74
Brantley, Ala.:
description 75
discharge 75
Cooperation, acknowledgments for 16
Coosa River at—
Riverside, Ala.:
description 79
discharge 79
discharge, monthly 81
gage heights 80
rating table 81
Coosawattee River at—
Carters, Ga.:
description 83
discharge 83
discharge, monthly 84
gage heights 83
rating table 83
Cordova, Ala.,
Black Warrior River near:
description 92
discharge 92
discharge, monthly 93
gage heights 92-93
rating table 93

Page.
Current meters, classes of 10
methods of using 10-11
plate showing 10
Current-meter station, view of 10
Curves (discharge, area, and velocity), figure showing 15

D.

Dadeville, Ala.,
North Fork Sandy Creek near:
discharge 97
Tallapoosa River near:
description 96
discharge 96
Timbercut Creek near:
discharge 97
Definitions of terms used 4
Demorest, Ga.,
Soque River near:
description 57
discharge 57
discharge, monthly 58
gage heights 57
rating table 58
Discharge, methods of measuring and computing 13-16
Drainage basins, list of 2-3
location of, map showing 2
Dublin, Ga.,
Oconee River at:
description 46-47
discharge 47
discharge, monthly 48
gage heights 47
rating table 47

E.

Eastern Gulf States drainages 51-102
Elba, Ala.,
Pea River at:
description 70, 72
discharge 70, 72
gage heights 70
Whitewater River at:
description 72
discharge 73
Ellaville, Fla.,
Suwanee River at:
description 52
discharge 52
Emuckfaw Creek at—
Hamlet, Ala.:
description 96
discharge 96
Epes, Ala.,
Tombigbee River at:
description 90-91
discharge 91
discharge, monthly 92
gage heights 91
rating table 91
Equivalents, table of 6-7
Escambia River basin:
description of 73
miscellaneous measurement in 75

Etowah River at and near— Page.
Canton, Ga.:
description 94
discharge 94
Rome, Ga.:
description 77
discharge 77
discharge, monthly 79
gage heights 78
rating table 78

F.

Flat Rock, N. C.,
Green River near:
description 24
discharge 24
Flint River at and near—
Albany, Ga.:
description 61-62
discharge 62
discharge, monthl 63
gage heights 62
rating table 63
Montezuma, Ga.:
description 60
discharge 60
discharge, monthly 61
gage heights 60
rating table 61
Woodbury, Ga.:
description 58
discharge 58
discharge, monthly 59
gage heights 59
rating table 59
Floats, use of, in measuring discharge 10
Follansbee, Robert, work of 1
Fraleys Ferry (near Milledgeville), Ga.,
Oconee River at:
description 45
discharge 45
gage heights 46
rating table 46

G.

Gaging stations, equipment of 9-10
location of, map showing 2
Gainesville, Ga., power plant near, view of. 86
Green River near—
Flat Rock, N. C.:
description 24
discharge 24
Greensboro, Ga.:
Oconee River near:
description 43
discharge 44
discharge, monthly 45
gage heights 44
rating tables 44
Groveland, Ga.,
Cannoochee River near:
description 34
discharge 34
discharge, monthly 36
gage heights 35
rating table 35

H. Page.

Hall, M. R., work in charge of 1
Hall, W. E., work of 1
Hamlet, Ala.,
Emuckfaw Creek at:
description 96
discharge 96
Hampton, Ala.,
Chattahaspee Creek near:
description 96
discharge 96
Chickasanocsa Creek near:
description 96
discharge 96
Heflin, Ala.,
Tallapoosa River near:
description 95
discharge 95
Henshaw, F. F., work of 1
Highpine Creek at—
Liles Mill, Ala.:
description 96
discharge 96
Horsepower, calculation of 5-6
Hoyt, J. C., work in charge of 1
Hydrographic surveys, organization and scope of 2

I.

Ice-covered streams, method of measuring flow of 13
Ichawaynochaway Creek at and near—
Milford, Ga.:
description 65
discharge 65
discharge, monthly 67
gage heights 66
rating table 66

J.

Jackson, Ga.,
Ocmulgee River near:
description 37
discharge 37
discharge, monthly 38
gage heights 38
rating table 38
Jackson, Miss.,
Pearl River at:
description 99
discharge 99
discharge, monthly 100
gage heights 99
rating table 100
Jenifer, Ala.,
Choccolocco Creek near:
description 84
discharge 84
discharge, monthly 85
gage heights 84-85
rating table 85
John River near—
Morganton, N. C.:
description 24
discharge 24

K. Page.
Kentwood, La.,
Tangipahoa River near:
description 101
discharge 101
Kinchafoonee Creek near—
Leesburg, Ga.:
description 63
discharge 64
discharge, monthly 65
gage heights 64
rating table 64

L.
Leesburg, Ga.,
Kinchafoonee Creek near:
description 63
discharge 64
discharge, monthly 65
gage heights 64
rating table 64
Muckalee Creek near:
description 68
discharge 68
Liles Mill, Ala.,
Highpine Creek at:
description 96
discharge 96
Little Cedar Creek at—
Cavespring, Ga.:
description 95
discharge 95
Little River near—
Toonigh, Ga.:
description 94
discharge 94
Little Sandy Creek near—
Camphill, Ala.:
description 97
discharge 97
Lucina, Ala.,
Tallapoosa River at:
description 96
discharge 96
Luxapelila Creek near—
Columbus, Miss.:
description 98
discharge 98

M.
Macon, Ga.,
Oakoxnubee River near—
description 98
discharge 98
Ocmulgee River at:
description 39
discharge 39
discharge, monthly 40
gage heights 39
rating table 40
Madison, S. C.,
Tugaloo River near:
description 27
discharge 27
discharge, monthly 28
gage heights 27
rating table 28
Meltons Mill, Ala.,
Wind Creek near:
discharge 97
Milford, Ga., Page.
Ichawaynochaway Creek at:
description 65
discharge 65
discharge, monthly 67
gage heights 66
rating table 66
Milledgeville, Ga.,
Oconee River at Fraleys Ferry near:
description 45
discharge 45
gage heights 46
rating table 46
Miner's inch, definition of 4
Mobile River basin:
description of 75
miscellaneous measurements in 94-98
Montezuma, Ga.,
Flint River near:
description 60
discharge 60
discharge, monthly 61
gage heights 60
rating table 61
Montgomery Power Company, power plant of, view of 86
Montpelier, La.,
Tickfaw River near:
description 102
discharge 102
Morganton, N. C.,
Catawba River near:
description 19
discharge 19
discharge, monthly 20
gage heights 19
rating table 19
John River near:
description 24
discharge 24
Muckalee Creek near—
Leesburg, Ga:
description 68
discharge 68
Multiple-point method of measuring discharge, description of 12
Murray, F. A., work of 1

N.
Newton, Ala.,
Choctawhatchee River near:
description 68-69
discharge 69
gage heights 69
rating table 69
Noonday Creek near—
Toonigh, Ga:
description 94
discharge 94
Norcross, Ga.,
Chattahoochee River near:
description 54
discharge 54
discharge, monthly 55
gage heights 54
rating table 55

North Fork Sandy Creek near— Page.
Dadesville, Ala.:
discharge..... 97
North Georgia Electric Power Company, plant of, view of..... 86

O.

Oakoxnubee River near—
Macon, Miss.:
description..... 98
discharge..... 98
Ocmulgee River at or near—
Jackson, Ga.:
description..... 37
discharge..... 37
discharge, monthly..... 38
gage heights..... 38
rating table..... 38
Macon, Ga.:
description..... 39
discharge..... 39
discharge, monthly..... 40
gage heights..... 39
rating table..... 40
Oconee River at and near—
Dublin, Ga.:
description..... 46-47
discharge..... 47
discharge, monthly..... 48
gage heights..... 47
rating table..... 47
Fraleys Ferry (near Milledgeville), Ga.:
description..... 45
discharge..... 45
gage heights..... 46
rating table..... 46
Greensboro, Ga.:
description..... 43
discharge..... 44
discharge, monthly..... 45
gage heights..... 44
rating table..... 44
Ogeechee River basin:
description..... 34
Ohoopee River near—
Reidsville, Ga.:
description..... 48
discharge..... 48
discharge, monthly..... 49
gage heights..... 48-49
rating table..... 49
Oostanaula River at—
Resaca, Ga.:
description..... 81
discharge..... 81
discharge, monthly..... 82
gage heights..... 81-82
rating table..... 82
Owsley, Ga.,
Withlacoochee River near:
description..... 52-53
discharge..... 53

P.

Padgett, H. D., work of..... 1
Pea River at—
Elba, Ala.:
description..... 70, 72
Pea River at— Page.
Elba, Ala.—Continued.
discharge..... 70, 72
gage heights..... 70
Pera, Ala.:
description..... 71
discharge..... 71
discharge, monthly..... 72
gage heights..... 71
rating table..... 72
Pearl River at—
Jackson, Miss.:
description..... 99
discharge..... 99
discharge, monthly..... 100
gage heights..... 99
rating table..... 100
Pearl River basin:
description..... 98
Pera, Ala.,
Pea River at:
description..... 71
discharge..... 71
discharge, monthly..... 72
gage heights..... 71
rating table..... 72
Pontchartrain, Lake, basin:
miscellaneous measurements in..... 101-102
Power plants, views of..... 54, 86, 88
Price current meter, views of..... 10

R.

Rating tables, construction of..... 14-15
Red Oak Creek near—
Woodbury, Ga.:
description..... 67
discharge..... 67
Reidsville, Ga.,
Ohoopee River near:
description..... 48
discharge..... 48
discharge, monthly..... 49
gage heights..... 48-49
rating table..... 49
Resaca, Ga.,
Oostanaula River at:
description..... 81
discharge..... 81
discharge, monthly..... 82
gage heights..... 81-82
rating table..... 82
Riverside, Ala.,
Coosa River at:
description..... 79
discharge..... 79
discharge, monthly..... 81
gage heights..... 80
rating table..... 80
Rome, Ga.,
Etowah River near:
description..... 77
discharge..... 77
discharge, monthly..... 79
gage heights..... 78
rating table..... 78
Run-off, computation of..... 13-16
Run-off in inches, definition of..... 4

S. Page.

Sahatonchee Creek near—
West Point, Miss.:
description 98
discharge 98
St. Johns River basin 50
Sandy Creek near—
Camphill, Ala.:
discharge 96
Dadeville, Ala.:
discharge 97
Santee River basin:
description 17-18
miscellaneous measurements in 24
Savannah River at—
Augusta, Ga.:
description 30
discharge 30
discharge, monthly 31
gage heights 30-31
rating table 31
Woodlawn, S. C.:
description 28
discharge 28
discharge, monthly 30
gage heights 29
rating table 29
Savannah River basin:
description of 24-25
miscellaneous measurements in 33-34
Second-feet per square mile, definition of ... 4
Second-foot, definition of 4
Selma, Ala.,
Alabama River at:
description 75
discharge 76
discharge, monthly 77
gage heights 76
rating table 77
Silver Springs at—
Silver Springs, Fla.:
description 50
discharge 50
gage heights 50
Single-point method of measuring discharge, description of 12
Slope method of measuring discharge, use and value of 8
Soque River near—
Demorest, Ga.:
description 57
discharge 57
discharge, monthly 58
gage heights 57
rating table 58
Sougahatchee Creek near—
Thaddeus, Ala.:
description 97
discharge 97
South Fork Sandy Creek near—
Camphill, Ala.:
description 97
discharge 97
South Atlantic States drainages 17-50
Spring Creek near—
Bainbridge, Ga.:
description 68
discharge 68

Page.

Stewart, J. E., work of 1
Stewart, Ga.,
Alcovy River near:
description 40
discharge 41
discharge, monthly 42
gage heights 41
rating table 41
Stream flow, measurement and computation of 7-13
papers on, list of 3
Sturdevant, Ala.,
Tallapoosa River at:
description 86
discharge 86
discharge, monthly 87
gage heights 86
rating table 87
Surface water supply, papers on, list of 2-3
Susanna, Ala.,
Blue Creek at:
discharge 97
Suwanee River at or near—
Ellaville, Fla.:
description 52
discharge 52
Suwanee, Fla.:
description 51, 52
discharge 51, 52
gage heights 52
Suwanee Springs near—
Suwanee, Fla.:
description 52
discharge 52

T.

Tables, explanation of 4-6
Tallapoosa River at or near—
Dadeville, Ala.:
description 96
discharge 96
Heflin, Ala.:
description 95
discharge 95
Louina, Ala.:
description .....
discharge 96
Sturdevant, Ala.:
description 86
discharge 86
discharge, monthly 87
gage heights 86
rating table 87
Tallapoosa, Ga.:
description 95
discharge 95
power plants on, views of 86, 88
survey of 87
Tallassee, Ala., power plant at and near, views of 86, 88
Tallassee Falls Manufacturing Co., power plant of, view of 88
Tallulah River at—
Tallulah Falls, Ga.:
description 25
discharge 25
discharge, monthly 26

Page.

Tallulah River at—
Tallulah Falls, Ga.—Continued.
gage heights..... 25-26
rating table..... 26
Tangipahoa River near—
Amite, La.:
description..... 101-102
discharge..... 102
Kentwood, La.:
description..... 101
discharge..... 101
Tangipahoa, La.:
description..... 101
discharge..... 101
Thaddeus, Ala.,
Sougahatchee Creek near:
description..... 97
discharge..... 97
Thomaston, Ga.,
Big Potato Creek near:
description..... 67-68
discharge..... 68
Tibbee River near—
West Point, Miss.:
description..... 98
discharge..... 98
Tickfaw River near—
Montpelier, La.:
description..... 102
discharge..... 102
Timbercut Creek near—
Dadeville, Ala.:
discharge..... 97
Tombigbee River at—
Columbus, Miss.:
description..... 89
discharge..... 89
discharge, monthly..... 90
gage heights..... 89-90
rating table..... 90
Epes, Ala.:
description..... 90-91
discharge..... 91
discharge, monthly..... 92
gage heights..... 91
rating table..... 91
Toonigh, Ga.,
Little River near:
description..... 94
discharge..... 94
Noonday Creek near:
description..... 94
discharge..... 94
Toonigh Creek near:
description..... 94
discharge..... 94
Tugaloo River near—
Madison, S. C.:
description..... 27
discharge..... 27
discharge, monthly..... 28
gage heights..... 27
rating table..... 28

V.

Velocity method of measuring discharge, description of..... 9-13
Vertical-integration method of measuring discharge, description of..... 12

Page.

Vertical-velocity method of measuring discharge, description of..... 11
Vinings, Ga.,
Chattahoochee River near:
description..... 67
discharge..... 67

W.

Warnerton, La.,
Bogue Chitto at:
description..... 100
discharge..... 101
gage heights..... 101
Water supply, surface, papers on, list of..... 2-3
Wateree River near—
Camden, S. C.:
description..... 20
discharge..... 20
discharge, monthly..... 22
gage heights..... 21
rating table..... 21
Weir method of measuring discharge, requirements of..... 8-9
West Point, Ga.,
Chattahoochee River at:
description..... 55
discharge..... 55
discharge monthly..... 56
gage heights..... 56
rating table..... 56
Sahatonchee Creek near:
description..... 98
discharge..... 98
Tibbee River near:
description..... 98
discharge..... 98
Whitewater River at—
Elba, Ala.:
description..... 72
discharge..... 73
Wind Creek near—
Meltons Mill, Ala.:
discharge..... 97
Withlacoochee River (of Florida) near—
Dade City, Fla.:
discharge..... 51
Owsley, Ga.:
description..... 52-53
discharge..... 53
Woodbury, Ga.,
Flint River near:
description..... 58
discharge..... 58
discharge, monthly..... 59
gage heights..... 59
rating table..... 59
Red Oak Creek near:
description..... 67
discharge..... 67
Woodlawn, S. C.,
Savannah River at:
description..... 28
discharge..... 28
discharge, monthly..... 30
gage heights..... 29
rating table..... 29

CLASSIFICATION OF THE PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

[Water-Supply Paper No. 204.]

The publications of the United States Geological Survey consist of (1) Annual Reports; (2) Monographs; (3) Professional Papers; (4) Bulletins; (5) Mineral Resources; (6) Water-Supply and Irrigation Papers; (7) Topographic Atlas of United States, folios and separate sheets thereof; (8) Geologic Atlas of United States, folios thereof. The classes numbered 2, 7, and 8 are sold at cost of publication; the others are distributed free. A circular giving complete lists can be had on application.

Most of the above publications can be obtained or consulted in the following ways:

1. A limited number are delivered to the Director of the Survey, from whom they can be obtained, free of charge (except classes 2, 7, and 8), on application.

2. A certain number are delivered to Senators and Representatives in Congress, for distribution.

3. Other copies are deposited with the Superintendent of Documents, Washington, D. C., from whom they can be had at practically cost.

4. Copies of all Government publications are furnished to the principal public libraries in the large cities throughout the United States, where they can be consulted by those interested.

The Professional Papers, Bulletins, and Water-Supply Papers treat of a variety of subjects, and the total number issued is large. They have therefore been classified into the following series: A, Economic geology; B, Descriptive geology; C, Systematic geology and paleontology; D, Petrography and mineralogy; E, Chemistry and physics; F, Geography; G, Miscellaneous; H, Forestry; I, Irrigation; J, Water storage; K, Pumping water; L, Quality of water; M, General hydrographic investigations; N, Water power; O, Underground waters; P, Hydrographic progress reports.

Series P.—The hydrographic progress reports contain the results of stream measurements. A report is issued for every calendar year, containing the results of data collected during that year. These reports were first published as a part of the Director's annual report or as a bulletin; they are now published as water-supply and irrigation papers. The following is a list, by years, of the publications containing the progress reports of stream measurements (* means out of stock). A detailed index of these reports (1888–1903) is published as Water-Supply Paper No. 119.

1888. Tenth Annual Report, Part II*.
1889. Eleventh Annual Report, Part II*.
1890. Twelfth Annual Report, Part II*.
1891. Thirteenth Annual Report, Part III*.
1892. Fourteenth Annual Report, Part II*.
1893. Bulletin No. 131*.
1894. Bulletin No. 131*; Sixteenth Annual Report, Part II*.
1895. Bulletin No. 140*.
1896. Water-Supply Paper No. 11*; Eighteenth Annual Report, Part IV*.
1897. Water-Supply Papers Nos. 15* and 16*; Nineteenth Annual Report, Part IV*.
1898. Water-Supply Papers Nos. 27* and 28*; Twentieth Annual Report, Part IV*.
1899. Water-Supply Papers Nos. 35*, 36*, 37*, 38*, and 39*; Twenty-first Annual Report, Part IV*.
1900. Water-Supply Papers Nos. 47, 48, 49, 50, 51, and 52; Twenty-second Annual Report, Part IV.
1901. East of Mississippi River, Water-Supply Papers Nos. 65* and 75*.
West of Mississippi River, Water-Supply Papers Nos. 66 and 75*.

1902. East of Mississippi River, Water-Supply Papers Nos. 82 and 83.
West of Mississippi River, Water-Supply Papers Nos. 84 and 85.
1903. East of Mississippi River, Water-Supply Papers Nos. 97 and 98.
West of Mississippi River, Water-Supply Papers Nos. 99 and 100.
1904. East of Mississippi River, Water-Supply Papers Nos. 124, 125, 126, 127, 128, and 129.
West of Mississippi River, Water-Supply Papers Nos. 130, 131, 132, 133, 134, and 135.
1905. East of Mississippi River, Watter-Supply Papers Nos. 165*, 166*, 167, 168*, 169, 170, and 171.
West of Mississippi River, Water-Supply Papers Nos. 171, 172*, 173*, 174, 175*, 176, 177, and 178.
1906. East of Mississippi River, Water-Supply Papers Nos. 201, 202, 203, 204, 205, 206, and 207.
West of Mississippi River, Water-Supply Papers Nos. 207 208, 209, 210, 211, 212, 213, and 214.

Correspondence should be addressed to

THE DIRECTOR,
UNITED STATES GEOLOGICAL SURVEY,
WASHINGTON, D. C.

JULY, 1907.

O

Water-Supply and Irrigation Paper No. 205 Series P, Hydrographic Progress Reports, 59

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

SURFACE WATER SUPPLY

OF

OHIO AND LOWER EASTERN MISSISSIPPI RIVER DRAINAGES, 1906

M. R. HALL, N. C. GROVER, and A. H. HORTON
DISTRICT HYDROGRAPHERS.

WASHINGTON
GOVERNMENT PRINTING OFFICE
1907

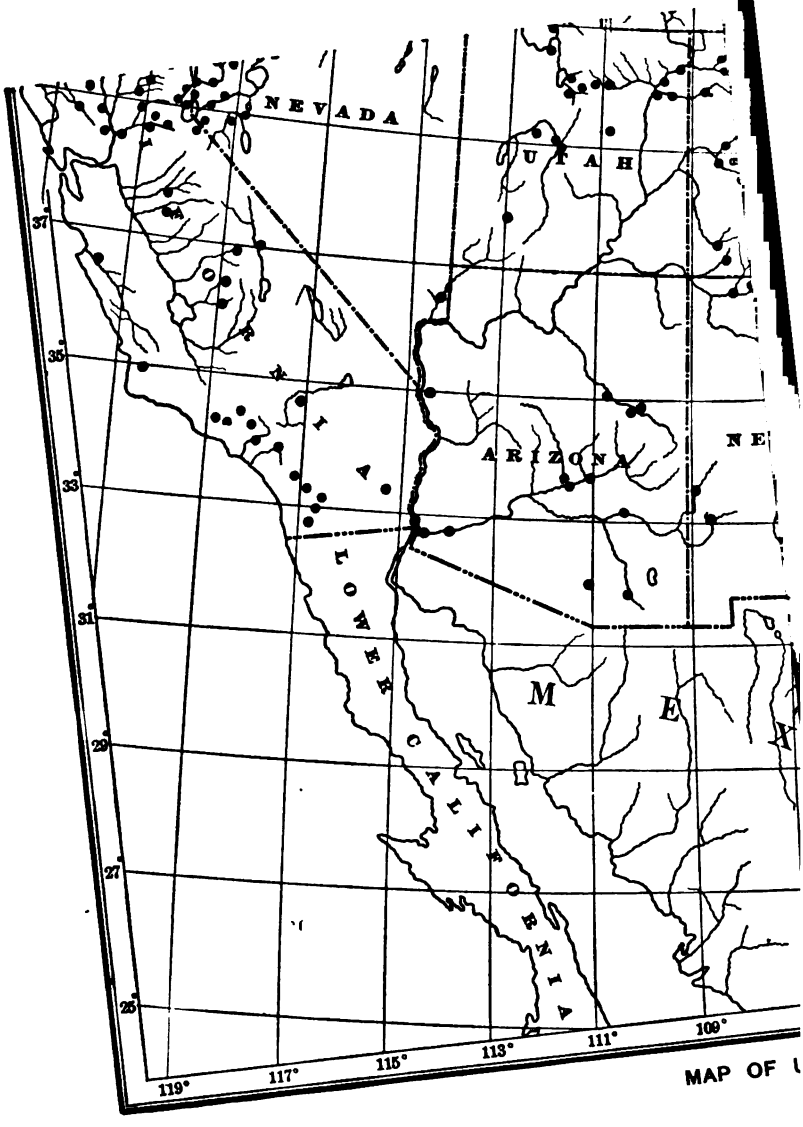
CONTENTS.

	Page.
Introduction	7
Scope of work	7
Definitions	9
Explanation and use of tables	10
Convenient equivalents	12
Field methods of measuring stream flow	13
Office methods of computing run-off	19
Cooperation and acknowledgments	22
Ohio River drainages	23
Ohio River drainage basin	23
Description of basin	23
Ohio River at Wheeling, W. Va	25
Allegheny River drainage basin	27
Description of basin	27
Allegheny River at Redhouse, N. Y	28
Allegheny River at Kittanning, Pa	30
Blacklick Creek at Blacklick, Pa	32
Monongahela River drainage basin	33
Description of basin	33
Youghiogheny River near Confluence, Pa	34
Casselman River at Confluence, Pa	35
Laurel Hill Creek at Confluence, Pa	37
Beaver River drainage basin	39
Description of basin	39
Mahoning River at Youngstown, Ohio	39
Muskingum River drainage basin	41
Description of basin	41
Muskingum River at Zanesville, Ohio	41
Licking River at Pleasant Valley, Ohio	43
Kanawha River drainage basin	45
Description of basin	45
New River at Radford, Va	46
Greenbrier River at Alderson, W. Va	47
Scioto River drainage basin	49
Description of basin	49
Scioto River near Columbus, Ohio	49
Olentangy River near Columbus, Ohio	50
Little Miami River drainage basin	51
Description of basin	51
Little Miami River at Loveland, Ohio	51
Mad River near Springfield, Ohio	52

Ohio River drainages—Continued. Page.
Miami River drainage basin 54
Description of basin 54
Miami River at Dayton, Ohio 55
Kentucky River drainage basin 57
Description of basin 57
Kentucky River at Frankfort, Ky 57
Salt River drainage basin 58
Description of basin 58
Rolling Fork of Salt River at New Haven, Ky 58
Wabash River drainage basin 59
Description of basin 59
Wabash River at Logansport, Ind 60
Wabash River at Terre Haute, Ind 62
Tippecanoe River near Delphi, Ind 64
West Branch of White River at Indianapolis, Ind 66
Eel River at Cataract, Ind 68
East Branch of White River at Shoals, Ind 68
Tennessee River drainage basin 70
Description of basin 70
French Broad River at Horseshoe, N. C 70
French Broad River near Asheville, N. C 72
Tennessee River near Knoxville, Tenn 73
Tennessee River at Chattanooga, Tenn 75
Davidsons River near Davidsons River, N. C 77
North Fork Mills River at Pinkbed, N. C 79
South Fork Mills River near Sitton, N. C 81
Nolichucky River near Greeneville, Tenn 83
South Fork Holston River at Bluff City, Tenn 85
Holston River at Austins Mills, Tenn 87
Watauga River near Elizabethton, Tenn 89
Little Tennessee River at Judson, N. C 91
Little Tennessee River at McGhee, Tenn 93
Tuckasegee River at Bryson, N. C 95
Hiwassee River at Murphy, N. C 97
Hiwassee River at Reliance, Tenn 99
Valley River at Tomotla, N. C 101
Okoee River at McCays, Tenn 104
Elk River near Elkmont, Ala 105
Duck River at Columbia, Tenn 107
Miscellaneous measurements 110
Lower Eastern Mississippi River drainages 112
Yazoo River drainage basin 112
Description of basin 112
Tallahatchie River at Batesville, Miss 113
Yalobusha River at Grenada, Miss 113
Homochitto River drainage basin 114
Description of basin 114
Homochitto River at Rosetta, Miss 115
Index 117

ILLUSTRATIONS.

		Page.
PLATE I.	Map of United States showing location of principal river stations maintained during 1906	7
II.	*A*, Current-meter rating station at Los Angeles, Cal.; *B*, Price current meters	16
III.	Okoee River near Ducktown, Tenn	104
FIG. 1.	Cable station, showing section of river, car, gage, etc	17
2.	Discharge, area, and mean-velocity curves for Ohio River at Wheeling, W. Va	21


NEVADA
UTAH
ARIZONA
NE
M
E
X
37°
35°
33°
31°
29°
27°
25°
119°
117°
115°
113°
111°
109°

MAP OF U

E WATER SUPPLY OF THE OHIO AND LOWER EASTERN MISSISSIPPI RIVER DRAINAGES, 1906.[a]

M. R. HALL, N. C. GROVER, and A. H. HORTON,
District Hydrographers.[b]

INTRODUCTION.

SCOPE OF WORK.

water supply of the United States is of more importance to the pursuits of the people than is any other natural resource. In States the limit of agricultural development is determined by ount of water available for irrigation, while in all parts of the the increase in the population of cities and towns makes ry additional water supplies for domestic and industrial procuring which both the quantity and the quality of the water ay be obtained must be considered. The location of manufac- plants may depend largely on the water-power facilities and character of the water. The notable advances made in the transmission of power have led to the utilization of water for the operation of manufacturing establishments, railroads, unicipal lighting plants, many of which are at some distance he places at which the power is developed.

intelligent establishment and maintenance of enterprises or tries that depend on the use of water demands a thorough ledge of the flow of the streams and an understanding of the tions affecting that flow. This knowledge should be based on showing both the total flow and the distribution of the flow ghout the year, in order that normal fluctuations may be pro- d for. As the flow of a stream is variable from year to year, nates of future flow can be made only from a study of observa- covering several years. The rapid increase in the development

[a] is report contains information similar to that published in previous years under the title rt on Progress of Stream Measurements."

[b] e data presented in this paper have been collected as follows: Tennessee River drainage and eastern Mississippi River drainage by M. R. Hall, district hydrographer, assisted by W. E. Hall, Hall, and F. A. Murray; Ohio River drainage from the north by A. H. Horton, district hydrog- er, assisted by M. S. Brennan and E. F. Kriegsman; Ohio River drainage from the south by N. C. r, district hydrographer.

[c] data have been prepared for publication under the direction of John C. Hoyt, by R. H. Bolster, t Follansbee, F. F. Henshaw, J. E. Stewart, and H. D. Padgett.

of the water resources of the United States has caused a great demand by engineers for information in regard to the flow of streams, as it is now generally realized that the failure of many large power, irrigation, and other projects has been due to the fact that the plans were made without sufficient trustworthy information in respect to the water supply.

Owing to the broad scope of these hydrographic investigations and the length of time they should cover in order that the records may be of greatest value, it is, in general, impossible for private individuals to collect the necessary data, and as many of the streams traverse more than one State this work does not properly fall within the province of the State authorities. The United States Geological Survey has therefore, by means of specific appropriations by Congress, for several years systematically made records of stream flow, with the view to ultimately determining all the important features governing the flow of the principal streams of the country. In carrying out this plan stations are established on the streams and maintained for a period long enough to show their regimen or general behavior. When a record that is sufficient for this purpose has been obtained for any stream, the work on that stream is discontinued. The order in which the streams are measured is determined by the degree of their importance.

During 1906 the regimen of flow was studied at about 700 stations distributed along the various rivers throughout the United States, as shown on Pl. I. In addition to these records, data in regard to precipitation, evaporation, water power, and river profiles were obtained in many sections of the country.

These data have been assembled by drainage areas and are published in a series of fourteen Water-Supply and Irrigation Papers, Nos. 201 to 214, inclusive, each of which pertains to the surface-water resources of a group of adjacent areas. In these papers are embodied not only the data collected in the field, but also the results of computations based on these data, and other information that has a direct bearing on the subject, such as descriptions of basins and the streams draining them, utility of the water resources, etc. The list follows:

Water-Supply and Irrigation Papers on Surface Water Supply, 1906.

201. Surface water supply of New England, 1906. (Atlantic coast of New England drainage.)
202. Surface water supply of the Hudson, Passaic, Raritan, and Delaware river drainages, 1906.
203. Surface water supply of the Middle Atlantic States, 1906. (Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages.)
204. Surface water supply of the Southern Atlantic and Eastern Gulf States, 1906. (Santee, Savannah, Ogeechee, and Altamaha rivers, and eastern Gulf of Mexico drainages.)

205. Surface water supply of the Ohio and lower eastern Mississippi river drainages, 1906.
206. Surface water supply of the Great Lakes and St. Lawrence River drainages, 1906.
207. Surface water supply of the upper Mississippi River and Hudson Bay drainages, 1906.
208. Surface water supply of the Missouri River drainage, 1906.
209. Surface water supply of the lower western Mississippi River drainage, 1906.
210. Surface water supply of the western Gulf of Mexico and Rio Grande drainages, 1906.
211. Surface water supply of the Colorado River drainage above Yuma, 1906.
212. Surface water supply of the Great Basin drainage, 1906.
213. Surface water supply of California, 1906. (The Great Basin and Pacific Ocean drainages in California, and Colorado River drainage below Yuma.)
214. Surface water supply of the North Pacific Coast drainage, 1906.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing such records up to and including 1903 has been published in Water-Supply Paper No. 119. The following table gives, by years and primary drainage basins, the numbers of the papers on surface water supply, published from 1901 to 1906.

Numbers of Water-Supply Papers containing results of stream measurements, 1901–1906.[a]

	1901.	1902.	1903.	1904.	1905.	1906.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
Atlantic Coast of New England drainage	65 75	82	97	124	165	201
Hudson, Passaic, Raritan, and Delaware river drainages	65 75	82	97	125	166	202
Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages	65 75	82 83	97 98	126	167	203
Santee, Savannah, Ogeechee, and Altamaha rivers, and eastern Gulf of Mexico drainages	65 75	83	98	127	168	204
Ohio and lower eastern Mississippi river drainages	65 75	83	98	128	169	205
Great Lakes and St. Lawrence River drainages	65	83	97	129	170	206
Hudson Bay and upper eastern and western Mississippi River drainages	65 66 75	83 84 85	98 99 100	128 130	171	207
Missouri River drainage	66 75	84	99	130 131	172	208
Meramec, Arkansas, Red, and lower western Mississippi river drainages	66 75	84	99	131	173	209
Western Gulf of Mexico and Rio Grande drainages	66 75	84	99	132	174	210
Colorado River drainage above Yuma	66 75	85	100	133	175	211
The Great Basin drainage	66 75	85	100	133	176	212
The Great Basin and Pacific Ocean drainages in California, and Colorado River drainage below Yuma	66 75	85	100	134	177	213
North Pacific Coast drainage	66 75	85	100	135	178	214

[a] Reports containing data for years prior to 1901 are noted in the series list at the end of this paper.

DEFINITIONS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet per

square mile, and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbrevation for cubic foot per second and is the quantity of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the quantity of water that passes through an orifice 1 inch square under a head which varies locally. It has been commonly used by miners and irrigators throughout the West and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

"Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work. There is a convenient relation between the second-foot and the acre-foot: One second-foot flowing for twenty-four hours will deliver 86,400 cubic feet, or approximately 2 acre-feet.

EXPLANATION AND USE OF TABLES.

For each regular gaging station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of monthly and yearly discharges and run-off.
6. Tables showing discharge and horsepower and the number of days during the year when the same are available.

The descriptions of stations give such general information about the locality and equipment as would enable the reader to find and use the station, and they also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, name of the hydrographer, width and area of cross section, gage height, and discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. At most stations the gage is read in the morning and in the evening.

The discharge measurements and gage heights are the base data from which the other tables are computed. In cases of extensive development it is expected that engineers will use these original data in making their calculations, as the computations made by the Survey are based on the data available at the time they are made and should be reviewed and, if necessary, revised when additional data are available.

The rating table gives the discharge in second-feet corresponding to various stages of the river as given by the gage heights. It is published to enable engineers to determine the daily discharge in case this information is desired.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow for each second during the month. Upon this the computations for the remaining columns, which are defined on page 10, are based.

The values in the table of monthly discharge are intended to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates.

In most work where data in regard to flow are used the regimen of flow is of primary importance. Therefore for the principal stations tables have been prepared showing the horsepower that can be developed at various rates of flow, and the length of time that these rates of flow and the corresponding horsepower are available. These tables have been prepared on a basis of 80 per cent efficiency on the turbines, and the horsepower per foot of fall is given in order that the reader can determine the horsepower for any fall.

In the computations, sufficient significent figures have been used so that the percentage of error in the tables will not in general exceed

1 per cent. Therefore, most of the values in the tables are given to only three significant figures. In making the various computations, Thatcher's slide rule, Crelle's tables, and computation machines have been generally used.

In order to give engineers an idea of the relative value of the various data, notes in regard to accuracy are given as far as possible. This accuracy depends on the general local conditions at the gaging stations and the amount of data collected. Every effort possible is made to so locate the stations that the data collected will give a high degree of accuracy. This is not always possible, but it is considered better to publish rough values with explanatory notes rather than no data.

In the accuracy notes the following terms have been used, indicating the probable accuracy, in per cent, of the mean monthly flow. As these values are mean values, the error in the value for the flow of any individual day may be much larger.

Excellent indicates that the mean monthly flow is probably accurate to within 5 per cent; good, to within 10 per cent; fair, to within 15 per cent; approximate, to within 25 per cent.

CONVENIENT EQUIVALENTS.

Following is a table of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second-foot-for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equal 18.7 United States gallons per second.
100 California miner's inches equal 96.0 Colorado miner's inches.
100 California miner's inches for one day equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 104 California miner's inches.
100 Colorado miner's inches for one day equal 5.17 acre-feet.
100 United States gallons per minute equal 0.223 second-foot.

100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1½ horsepower equal about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel, realizing 80 per cent of theoretical power.

FIELD METHODS OF MEASURING STREAM FLOW.

The methods used in collecting these data and in preparing them for publication are given in detail in Water-Supply Papers No. 94 (Hydrographic Manual, U. S. Geological Survey) and No. 95 (Accuracy of Stream Measurements). In order that persons using this report may readily become acquainted with the general methods employed, the following brief descriptions are given:

Streams may be divided, with respect to their physical conditions, into three classes: (1) Those with permanent beds; (2) those with beds which change only during extreme low or high water; (3) those with constantly shifting beds. In determining the daily flow special methods are necessary for each class. The data upon which the determinations are based and the methods of collecting them are, however, in general the same.

There are three distinct methods of determining the flow of open-channel streams: (1) By measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir; (3) by measurements of the velocity of the current and of the area of the cross section. The method chosen for any case depends upon the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to the coefficients to be used in the Chezy formula, $v=c\sqrt{R\,s}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The results obtained by the slope method are in general only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for n to be used in Kutter's formula. The most common use of this method is in estimating the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions.

Weir method.—When funds are available and the conditions are such that sharp-crested weirs can be erected, these offer the best facilities for determining flow. If dams are suitably situated and constructed, they may be utilized for obtaining reliable measurements of flow. The conditions necessary to insure good results may be divided into two classes: (1) Those relating to the physical characteristics of the dam itself and (2) those relating to the diversion and use of water around and through the dam.

The physical requirements are as follows: (*a*) Sufficient height of dam, so that backwater will not interfere with free fall over it; (*b*) absence of leaks of appreciable magnitude; (*c*) topography or abutments which confine the flow over the dam at high stages; (*d*) level crests which are kept free from obstructions caused by floating logs or ice; (*e*) crests of a type for which the coefficients to be used in $Q=c\,b\,h^{\frac{3}{2}}$, or some similar standard weir formula, are known (see Water-Supply Papers Nos. 180 and 200[a]); (*f*) either no flash boards or exceptional care in reducing leakage through them and in recording their condition.

Preferably, there should be no diversion of water through or around the dam. Generally, however, a dam is built for purposes of power or navigation, and part or all of the water flowing past it is diverted for such uses. This water is measured and added to that passing over the dam. To insure accuracy in such determinations of flow the amount of water diverted should be reasonably constant. Furthermore, it should be so diverted that it can be measured either by a weir, a current meter, or a simple system of water wheels which are of standard make, or which have been rated as meters under working conditions and so installed that the gate openings, the heads under which they work, and their angular velocities may be accurately observed.

The combination of physical conditions and uses of the water should be such that the determinations of flow will not involve, for a critical stage of considerable duration, the use of a head on a broad-

[a] Water-Supply Paper No. 200 replaces No. 150, the edition of which has been exhausted.

crested dam of less than 6 inches. Moreover, when all other conditions are good, the cooperation of the owners or operators of the plant is still essential if reliable results are to be obtained.

A gaging station at a weir or dam has the general advantage of continuity of record through the period of ice and floods, and the disadvantages of uncertainty of coefficient to be used in the weir formula and of complications in the diversion and use of the water.

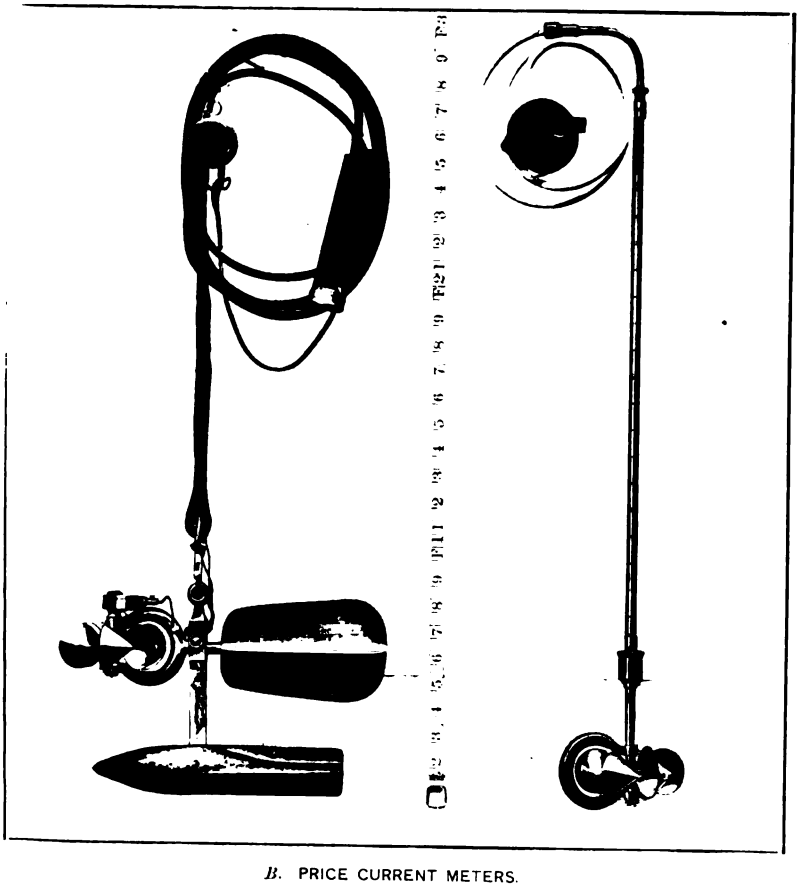
Velocity method.—The determination of the quantity of water flowing past a certain section of a stream at a given time is termed a discharge measurement. This quantity is the product of two factors—the mean velocity and the area of the cross section. The mean velocity is a function of surface slope, wetted perimeter, roughness of bed, and the channel conditions at, above, and below the gaging section. The area depends upon the contour of the bed and the fluctuations of the water surface. The two principal ways of measuring the velocity of a stream are by floats and current meters.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements in order that the data may have the required degree of accuracy. Their essential requirements are practically the same, whether the velocity is determined by meters or floats. They are located, as far as possible, where the channel is straight both above and below the gaging section; where there are no cross currents, backwater, or boils; where the bed of the stream is reasonably free from large projections of a permanent character, and where the banks are high and subject to overflow only at flood stages. The station must be so far removed from the effects of tributary streams and of dams or other artificial obstructions that the gage height shall be an index of the discharge.

Certain permanent or semipermanent structures, usually referred to as "equipment," are generally pertinent to a gaging station. These are a gage for determining the fluctuations of the water surface, bench marks to which the datum of the gage is referred, permanent marks on a bridge or a tagged line indicating the points of measurement, and, where the current is swift, some appliance (generally a secondary cable) to hold the meter in position in the water. As a rule, the stations are located at bridges if the channel conditions are satisfactory, as from them the observations can more readily be made and the cost of the equipment is small.

The floats in common use are the surface, subsurface, and tube or rod floats. A corked bottle with a flag in the top and weighted at the bottom makes one of the most satisfactory surface floats, as it is affected but little by wind. In case of flood measurements, good results can be obtained by observing the velocity of floating cakes of ice or débris. In case of all surface-float measurements coefficients must be used to reduce the observed velocity to the mean

A. CURRENT-METER RATING STATION AT LOS ANGELES, CAL.



B. PRICE CURRENT METERS.

section into strips. For each strip or pair of strips the mean velocity, area, and discharge are determined independently, so that conditions existing in one part of the stream may not be extended to parts where they do not apply.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

The three principal multiple-point methods in general use are the vertical velocity-curve; 0.2 and 0.8 depth; and top, bottom, and mid depth.

In the vertical velocity-curve method a series of velocity determinations are made in each vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve among the resulting points, the vertical velocity-curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the ver-

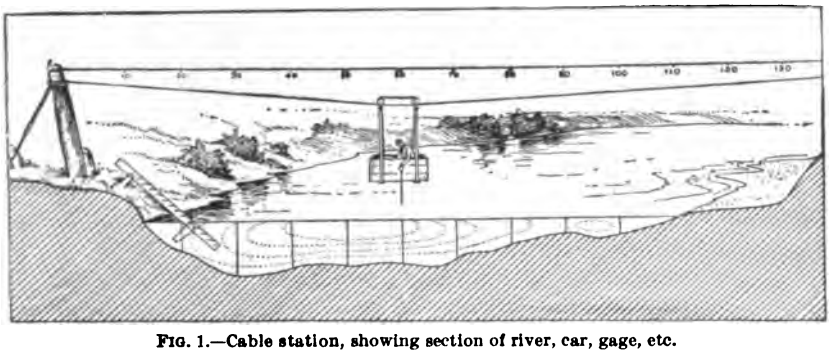


FIG. 1.—Cable station, showing section of river, car, gage, etc.

tical is then obtained by dividing the area bounded by this velocity curve and its axis by the depth. On account of the length of time required to make a complete measurement by this method, its use is limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 of the depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity-curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 of the depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this second multiple-point method gives the mean velocity very closely for open-water conditions, and, moreover, the indications are that it holds nearly as well for ice-covered rivers.

In the third multiple-point method the meter is held at mid depth,

at 0.5 foot below the surface, and at 0.5 foot above the bottom, and the mean velocity is determined by dividing by 6 the sum of the top velocity, four times the mid-depth velocity, and the bottom velocity. This method may be modified by observing at 0.2, 0.6, and 0.8 depth.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity, or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined.

Extensive experiments by vertical velocity-curves show that the thread of mean velocity generally occurs at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, at which point the meter is held in the majority of measurements. A large number of vertical velocity-curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be from 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is especially adapted for flood measurements or when the velocity is so great that the meter can not be kept at 0.6 depth.

The vertical integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface, and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods.

The area, which is the other factor in the velocity method of determining the discharge of a stream, depends on the stage of the river, which is observed on the gage, and on the general contour of the bed of the stream, which is determined by soundings. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable, or by a special sounding line or rod. For streams with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also of value in obtaining the area for use in computations of high-water measurements, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at various points of measurement the measuring section is divided into elementary strips, as shown in fig. 1, and the mean velocity, area, and discharge are determined separately for either a single or a double strip. The total discharge and the area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period and also to the lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8, and vertical velocity-curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, the thickness and character of the ice, etc.

From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice.

For information in regard to flow under ice cover see Water-Supply Paper No. 187.

OFFICE METHODS OF COMPUTING RUN-OFF.

There are two principal methods of determining run-off, depending on whether or not the bed of the stream is permanent.

For stations on streams with permanent beds the first step in computing the run-off is the construction of the rating table, which shows the discharge corresponding to any stage of the stream. This rating table is applied to the record of stage to determine the amount of water flowing. The construction of the rating table depends on the method used in measuring flow.

For a station at a weir or dam the basis for the rating table is some standard weir formula. The coefficients to be used in its application depend on the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and assumed coefficient, the discharge is computed for various heads and the rating table constructed.

The data necessary for the construction of a rating table for a velocity-area station are the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross section, the mean velocity of the current, and the quantity of water flowing. A thorough knowledge of the conditions at and in the vicinity of the station is also necessary.

The construction of the rating table depends on the following laws of flow for open, permanent channels: (1) The discharge will remain constant so long as the conditions at or near the gaging station remain constant; (2) the discharge will be the same whenever the stream is at a given stage if the change of slope due to the rise and fall of the stream be neglected; (3) the discharge is a function of and increases gradually with the stage.

The plotting of the results of the various discharge measurements, using gage heights as ordinates, and discharge, mean velocity, and area as abscissas, will define curves which show the discharge, mean velocity, and area corresponding to any gage height. For the development of these curves there should be, therefore, a sufficient number of discharge measurements to cover the range of the stage of the stream. Fig. 2 shows a typical rating curve, with its corresponding mean-velocity and area curves.

As the discharge is the product of two factors, the area and the mean velocity, any change in either factor will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is always concave toward the horizontal axis or on a stra ht line, unless the banks of the stream are overhanging.

The form of the mean-velocity curve depends chiefly upon the surface slope, the roughness of the bed, and the cross section of the stream. Of these the slope is the principal factor. In accordance with the relative change of these factors the curve may be either a straight line, convex or concave toward either axis, or a combination of the three. From a careful study of the conditions at any gaging station the form which the vertical velocity-curve will take can be predicted, and it may be extended with reasonable certainty to stages beyond the limits of actual measurements. Its principal use is in connection with the area curve in locating errors in discharge measurements and in constructing the rating table.

The discharge curve is defined primarily by the measurements of discharge, which are studied and weighted in accordance with the local conditions existing at the time of each measurement. The curve may, however, best be located between and beyond the measurements by means of curves of area and mean velocity. This curve under normal conditions is concave toward the horizontal axis and is generally parabolic in form.

In the preparation of the rating table the discharge for each tenth or half tenth on the gage is taken from the curve. The differences between successive discharges are then taken and adjusted according to the law that they shall either be constant or increasing.

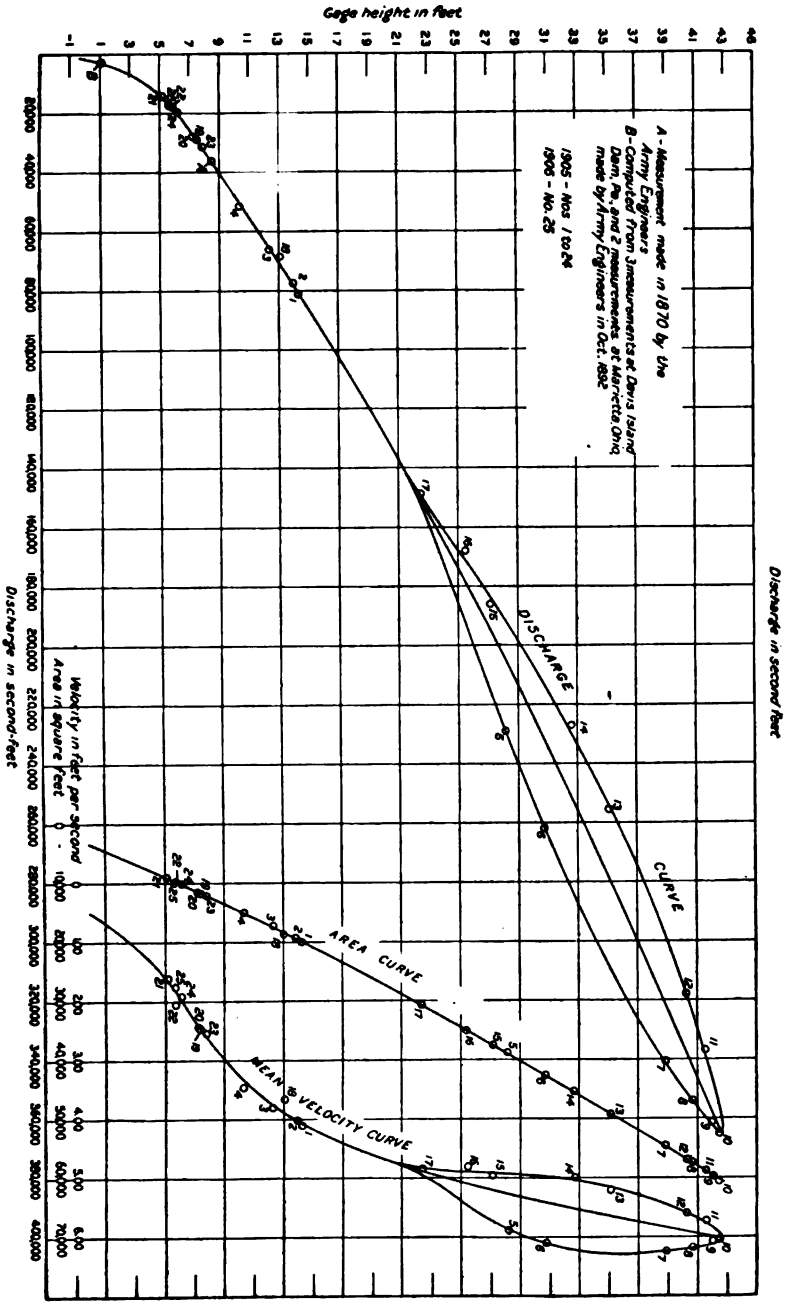


FIG. 2.—Rating, discharge, area, and mean-velocity curves for Ohio River at Wheeling, W. Va.

velocity. The subsurface and tube or rod floats are intended to give directly the mean velocity in the vertical. Tubes give excellent results when the channel conditions are good, as in canals.

In measuring velocity by a float, observation is made of the time taken by the float to pass over the "run," a selected stretch of river from 50 to 200 feet long. In each discharge measurement a large number of velocity determinations are made at different points across the stream, and from these observations the mean velocity for the whole section is determined. This may be done by plotting the mean positions of the floats as indicated by the distances from the bank as ordinates and the corresponding times as abscissas. A curve through these points shows the mean time of run at any point across the stream, and the mean time for the whole stream is obtained by dividing the area bounded by this curve and its axis by the width. The length of the run divided by the mean time gives the mean velocity.

The area used in float measurements is the mean of the areas at the two ends of the run and at several intermediate sections.

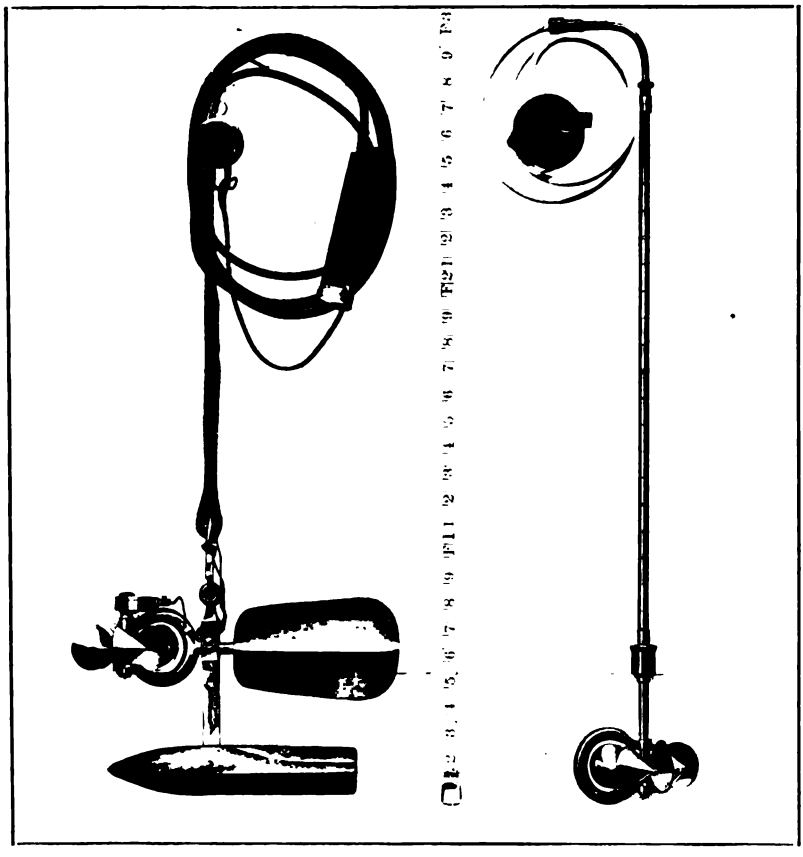
The essential parts of the current meters in use are a wheel of some type, so constructed that the impact of flowing water causes it to revolve, and a device for recording or indicating the number of revolutions. The relation between the velocity of the moving water and the revolutions of the wheel is determined for each meter. This rating is done by drawing the meter through still water for a given distance at different speeds, and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity per second for any number of revolutions.

Many kinds of current meters have been constructed. They may, however, be classed in two general types—those in which the wheel is made up of a series of cups, as the Price, and those having a screw-propeller wheel, as the Haskell. Each meter has been developed for use under some special condition. In the case of the small Price meter, shown in Pl. II, *B*, which has been largely developed and extensively used by the United States Geological Survey, an attempt has been made to get an instrument which could be used under practically all conditions.

Current-meter measurements may be made from a bridge, cable, boat, or by wading, and gaging stations may be classified in accordance with such use. Fig. 1 shows a typical cable station.

In making the measurement an arbitrary number of points are laid off on a line perpendicular to the thread of the stream. The points at which the velocity and depth are observed are known as measuring points and are usually fixed at regular intervals, varying from 2 to 20 feet, depending on the size and condition of the stream. Perpendiculars dropped from the measuring points divide the gaging

A. CURRENT-METER RATING STATION AT LOS ANGELES, CAL.



B. PRICE CURRENT METERS.

section into strips. For each strip or pair of strips the mean velocity, area, and discharge are determined independently, so that conditions existing in one part of the stream may not be extended to parts where they do not apply.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

The three principal multiple-point methods in general use are the vertical velocity-curve; 0.2 and 0.8 depth; and top, bottom, and mid depth.

In the vertical velocity-curve method a series of velocity determinations are made in each vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve among the resulting points, the vertical velocity-curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the ver-

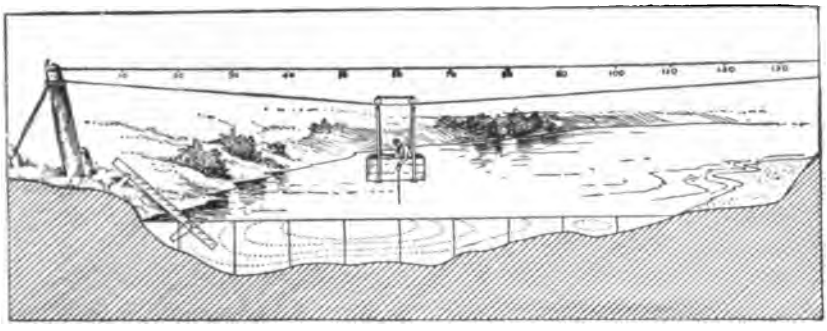


FIG. 1.—Cable station, showing section of river, car, gage, etc.

tical is then obtained by dividing the area bounded by this velocity curve and its axis by the depth. On account of the length of time required to make a complete measurement by this method, its use is limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 of the depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity-curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 of the depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this second multiple-point method gives the mean velocity very closely for open-water conditions, and, moreover, the indications are that it holds nearly as well for ice-covered rivers.

In the third multiple-point method the meter is held at mid depth,

at 0.5 foot below the surface, and at 0.5 foot above the bottom, and the mean velocity is determined by dividing by 6 the sum of the top velocity, four times the mid-depth velocity, and the bottom velocity. This method may be modified by observing at 0.2, 0.6, and 0.8 depth.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity, or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined.

Extensive experiments by vertical velocity-curves show that the thread of mean velocity generally occurs at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, at which point the meter is held in the majority of measurements. A large number of vertical velocity-curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be from 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is especially adapted for flood measurements or when the velocity is so great that the meter can not be kept at 0.6 depth.

The vertical integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface, and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods.

The area, which is the other factor in the velocity method of determining the discharge of a stream, depends on the stage of the river, which is observed on the gage, and on the general contour of the bed of the stream, which is determined by soundings. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable, or by a special sounding line or rod. For streams with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also of value in obtaining the area for use in computations of high-water measurements, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at various points of measurement the measuring section is divided into elementary strips, as shown in fig. 1, and the mean velocity, area, and discharge are determined separately for either a single or a double strip. The total discharge and the area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period and also to the lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8, and vertical velocity-curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, the thickness and character of the ice, etc.

From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice.

For information in regard to flow under ice cover see Water-Supply Paper No. 187.

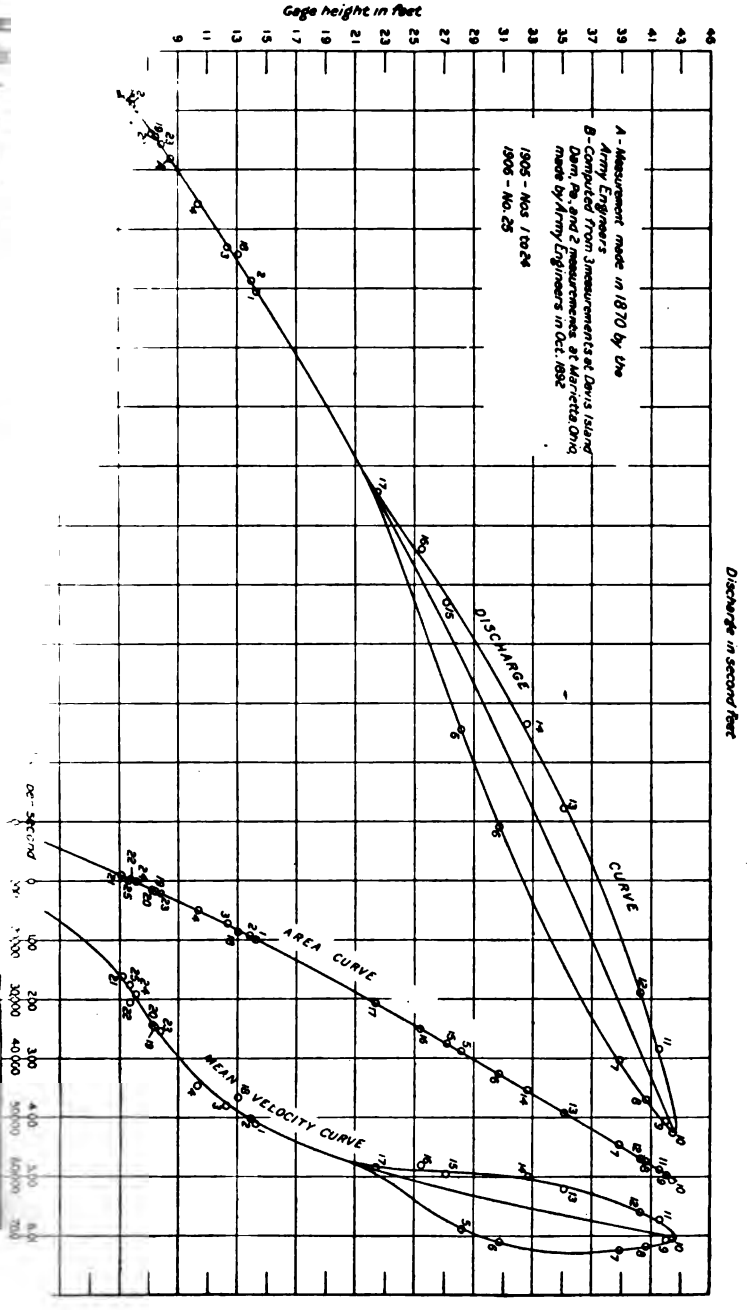
OFFICE METHODS OF COMPUTING RUN-OFF.

There are two principal methods of determining run-off, depending on whether or not the bed of the stream is permanent.

For stations on streams with permanent beds the first step in computing the run-off is the construction of the rating table, which shows the discharge corresponding to any stage of the stream. This rating table is applied to the record of stage to determine the amount of water flowing. The construction of the rating table depends on the method used in measuring flow.

For a station at a weir or dam the basis for the rating table is some standard weir formula. The coefficients to be used in its application depend on the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and assumed coefficient, the discharge is computed for various heads and the rating table constructed.

The data necessary for the construction of a rating table for a velocity-area station are the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross section, the mean velocity of the current, and the quantity of water flowing. A thorough knowledge of the conditions at and in the vicinity of the station is also necessary.


Gage height in feet
Discharge in second feet
A - Measurement made in 1870 by the Army Engineers
B - Computed from 3 measurements at Davis Island Dam, Pa. and 2 measurements at Marietta, Ohio made by Army Engineers in Oct. 1892
1905 - Nos 1 to 24
1906 - No. 25
DISCHARGE CURVE
AREA CURVE
MEAN VELOCITY CURVE

The construction of the rating table depends on the following laws of flow for open, permanent channels: (1) The discharge will remain constant so long as the conditions at or near the gaging station remain constant; (2) the discharge will be the same whenever the stream is at a given stage if the change of slope due to the rise and fall of the stream be neglected; (3) the discharge is a function of and increases gradually with the stage.

The plotting of the results of the various discharge measurements, using gage heights as ordinates, and discharge, mean velocity, and area as abscissas, will define curves which show the discharge, mean velocity, and area corresponding to any gage height. For the development of these curves there should be, therefore, a sufficient number of discharge measurements to cover the range of the stage of the stream. Fig. 2 shows a typical rating curve, with its corresponding mean-velocity and area curves.

As the discharge is the product of two factors, the area and the mean velocity, any change in either factor will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is always concave toward the horizontal axis or on a stra ht line, unless the banks of the stream are overhanging.

The form of the mean-velocity curve depends chiefly upon the surface slope, the roughness of the bed, and the cross section of the stream. Of these the slope is the principal factor. In accordance with the relative change of these factors the curve may be either a straight line, convex or concave toward either axis, or a combination of the three. From a careful study of the conditions at any gaging station the form which the vertical velocity-curve will take can be predicted, and it may be extended with reasonable certainty to stages beyond the limits of actual measurements. Its principal use is in connection with the area curve in locating errors in discharge measurements and in constructing the rating table.

The discharge curve is defined primarily by the measurements of discharge, which are studied and weighted in accordance with the local conditions existing at the time of each measurement. The curve may, however, best be located between and beyond the measurements by means of curves of area and mean velocity. This curve under normal conditions is concave toward the horizontal axis and is generally parabolic in form.

In the preparation of the rating table the discharge for each tenth or half tenth on the gage is taken from the curve. The differences between successive discharges are then taken and adjusted according to the law that they shall either be constant or increasing.

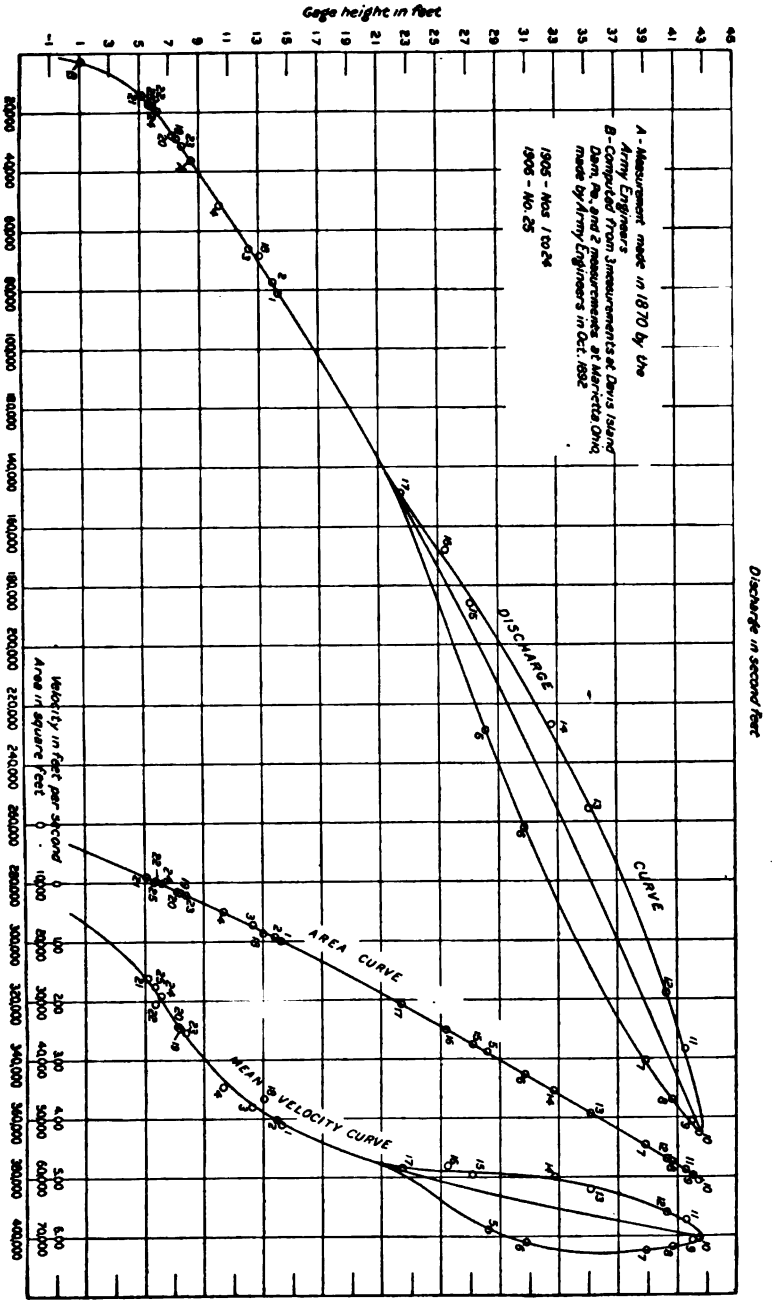


FIG. 2.—Rating, discharge, area, and mean-velocity curves for Ohio River at Wheeling, W. Va.

The determination of daily discharge of streams with changeable beds is a difficult problem. In case there is a weir or dam available, a condition which seldom exists on streams of this class, the discharge can be determined by its use. In case of velocity-area stations frequent discharge measurements must be made if the determinations of flow are to be other than rough approximations. For stations with beds which shift slowly, or are materially changed only during floods, rating tables can be prepared for periods between such changes and satisfactory results obtained with a limited number of measurements, provided that some of them are taken soon after the change occurs. For streams with continually shifting beds, such as the Colorado and Rio Grande, discharge measurements should be made every two or three days and the discharges for intervening days obtained either by interpolation modified by gage height or by Professor Stout's method, which has been described in full in the Nineteenth Annual Report United States Geological Survey, Part IV, page 323, and in the Engineering News of April 21, 1904. This method, or a graphical application of it, is also much used in determining the flow at stations where the bed shifts but slowly.

COOPERATION AND ACKNOWLEDGMENTS.

Assistance has been rendered or records furnished by the following, to whom special acknowledgment is due: Officers and employees of the United States Weather Bureau; officers and employees of the Corps of Engineers, United States Army; and the Illinois Central Railroad.

OHIO RIVER DRAINAGES.

OHIO RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Ohio River, which is formed by the junction of Allegheny and Monongahela rivers at Pittsburg, flows in a southwesterly direction, forming the boundaries between and draining the States of Ohio, Indiana, and Illinois on the north and West Virginia and Kentucky on the south. Its tributaries also drain portions of New York, Pennsylvania, Maryland, Virginia, North Carolina, Georgia, Alabama, and Mississippi.

The length of the stream, as surveyed by the United States Army engineers, from Pittsburg to Cairo is 967 miles.[a]

The river presents an interesting series of shoals and riffles, separated by pools in which the water is deeper and the fall very low. The summary of the profile made by the army engineers shows 187 pools with over 7 feet depth at low water. These occupy 632.5 miles and have an average length of 3.47 miles. Of these, 127 pools above Louisville, Ky., average 2.8 miles, with a total length of 363 miles; and 60 pools below Louisville, with a total length of 266 miles, have an average length of 4.4 miles.

On the borders of Ohio the riffles (103 in number) cover a combined length of 137 miles and have a total fall of 170 feet. The pools, with a combined length of 309 miles, have a fall of 64 feet, or but 2.5 inches per mile. The greatest fall noted for a single mile on the border of this State is at Letart Falls, Meigs County, where a descent of 3.2 feet is made. There are 11 riffles, with a descent exceeding 2 feet per mile. The least fall reported is in a pool 8 to 15 miles below Cincinnati. This pool, with a length of 7 miles, has a fall of but 3.5 inches. Another pool with about as low a fall is found 23 to 30 miles above Cincinnati. These are the most conspicuous pools in this section of the Ohio.

On the borders of Indiana there are 55 riffles aside from the Louisville rapids. These show a total fall of 80.28 feet in a combined distance of 134.5 miles. At the Louisville rapids there is a fall of 23.09 feet in 2.25 miles. There is left but 18.13 feet for the fall of the stream in about 215 miles embraced in the pools, or only 1 inch per mile.

[a] Ex. Doc. No. 72, House of Representatives, Forty-first Congress, third session, January, 1871, pp. 139-153.

In general the rock floor of the valley is 30 to 50 feet below the level of the stream at low water. It rarely reaches a lower level than 75 feet below the stream. Its level is 65 or 75 feet below the stream between Evansville, Ind., and Shawneetown, Ill. It is thought that no place occurs in the whole length of the valley where a rock barrier crosses its entire width at a level as high as the bed of the present stream. In several places rock shelves extend out part way across the river bed, leaving a channel deep enough for the passage of boats along the opposite bank. At Letart Falls the rock is stated to extend across the entire breadth of the stream, but it dips toward the east bank sufficiently to allow the passage of boats when the rock of the western part of the stream bed is above the water surface. Well data indicate that this descent continues eastward beneath the bottom lands to a level as low as in the neighboring parts of the channel. Near Ravenswood, W. Va., rocky reefs are exposed at low water fully halfway across the stream bed, but wells on the bottom lands near the village show the rock floor to be at least 25 feet below the stream at low water. At Louisville it is found by wells and bridge soundings that a channel 25 feet or more lower than the present surface at the head of the rapids leads southwestward from near the south end of the Jeffersonville bridge a short distance and then turns westward, passing through the midst of the city.[a] Thus at the side of each of the three most conspicuous rock reefs touched by the stream a buried channel apparently occurs.

Notwithstanding the great number of riffles and shoals, the Ohio is generally navigable throughout the entire season for small boats drawing less than 3 feet of water. It is navigable for vessels drawing 6 feet of water during a few months of the early part of the season, but there is usually little traffic with such boats after the month of July. The canal at Louisville affords opportunity for passing around the rapids during low water. During high-water stages the boats are able to pass over the rapids.

The valley of Ohio River along the southern boundary of Ohio and Indiana is very narrow except for a few miles near Louisville, where it has expanded itself in the Devonian shales, and for a similar widening in the southwestern portion of Indiana in the Coal Measures. Its narrowness has been a subject of remark from the early days of settlement. There are very few places between Pittsburg and Louisville where its width exceeds 2 miles, and usually it is scarcely more than 1 mile wide. In the vicinity of Louisville, where it crosses the low tract formed in the Devonian shales, it has a width of perhaps 4 miles, but on entering the Knobstone escarpment below the mouth of Salt River it narrows abruptly to a width of about 1 mile and remains narrow

[a] Data on this subject were furnished by Maj. William J. Davis, of the Louisville school board, and by Messrs. John Ryan and John C. Oestrich, of the Louisville Pump Works.

for nearly 100 miles in its passage through the hard beds of Lower Carboniferous age. It then enters the Coal Measures and soon attains a width of 6 or 8 miles, which it maintains for much of its course to Cairo. The only exception is found at the point where it passes the elevated ridge below Shawneetown, where its width is reduced to about 2½ miles. The depth of the valley ranges from about 600 feet down to scarcely 100 feet, being greatest on the border of the "panhandle" of West Virginia and least in the lower portion of its course. Its depth seldom falls below 300 feet in the portion above Louisville and probably averages 450 feet. The narrow portion below Louisville is about 300 feet deep. The broad portions at Louisville and in the lower parts of its course are but 100 to 150 feet in depth. The work done by the river in excavating a narrow valley through the elevated districts is apparently commensurate with that accomplished in eroding a wide valley in the low districts.

The entire work of the stream, however, is less than should have been accomplished by a drainage line of this size in the time since the beginning of development of drainage lines. It is far less in proportion to its size than the work accomplished by the small tributaries which enter it from southern Indiana. The explanation of this meager amount of work is found in the enlargement of the river in recent times. Investigations now in progress indicate that several independent drainage lines which formerly led northward from the Appalachian Mountains across southwestern New York, northwestern Pennsylvania, and Ohio into the Lake Erie basin have been united to form the present Ohio. The full extent of these changes is not yet determined, nor are all of the outlets for the old river systems satisfactorily traced; but enough is known to justify the statement that the small size of the valley of the Ohio is attributable to the recent union of the several independent drainage systems.

OHIO RIVER AT WHEELING, W. VA.

The United States Weather Bureau has made observations of the stage of Ohio River at Wheeling, W. Va., since 1882. In 1905 measurements of the flow were begun by the United States Geological Survey. Gage heights are furnished by the United States Weather Bureau. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 20.

section into strips. For each strip or pair of strips the mean velocity, area, and discharge are determined independently, so that conditions existing in one part of the stream may not be extended to parts where they do not apply.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

The three principal multiple-point methods in general use are the vertical velocity-curve; 0.2 and 0.8 depth; and top, bottom, and mid depth.

In the vertical velocity-curve method a series of velocity determinations are made in each vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve among the resulting points, the vertical velocity-curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the ver-

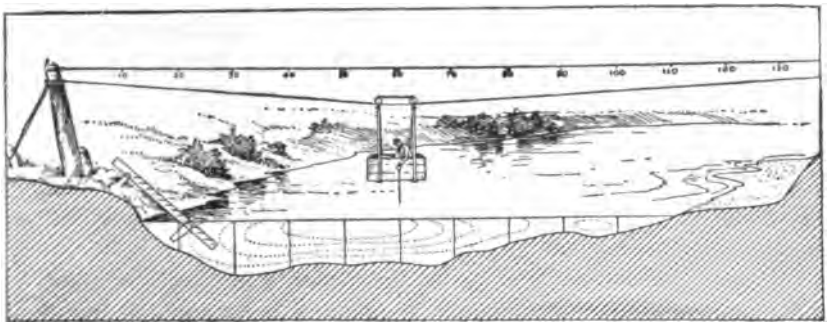


FIG. 1.—Cable station, showing section of river, car, gage, etc.

tical is then obtained by dividing the area bounded by this velocity curve and its axis by the depth. On account of the length of time required to make a complete measurement by this method, its use is limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 of the depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity-curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 of the depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this second multiple-point method gives the mean velocity very closely for open-water conditions, and, moreover, the indications are that it holds nearly as well for ice-covered rivers.

In the third multiple-point method the meter is held at mid depth,

at 0.5 foot below the surface, and at 0.5 foot above the bottom, and the mean velocity is determined by dividing by 6 the sum of the top velocity, four times the mid-depth velocity, and the bottom velocity. This method may be modified by observing at 0.2, 0.6, and 0.8 depth.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity, or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined.

Extensive experiments by vertical velocity-curves show that the thread of mean velocity generally occurs at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, at which point the meter is held in the majority of measurements. A large number of vertical velocity-curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be from 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is especially adapted for flood measurements or when the velocity is so great that the meter can not be kept at 0.6 depth.

The vertical integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface, and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods.

The area, which is the other factor in the velocity method of determining the discharge of a stream, depends on the stage of the river, which is observed on the gage, and on the general contour of the bed of the stream, which is determined by soundings. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable, or by a special sounding line or rod. For streams with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also of value in obtaining the area for use in computations of high-water measurements, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at various points of measurement the measuring section is divided into elementary strips, as shown in fig. 1, and the mean velocity, area, and discharge are determined separately for either a single or a double strip. The total discharge and the area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period and also to the lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8, and vertical velocity-curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, the thickness and character of the ice, etc.

From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice.

For information in regard to flow under ice cover see Water-Supply Paper No. 187.

OFFICE METHODS OF COMPUTING RUN-OFF.

There are two principal methods of determining run-off, depending on whether or not the bed of the stream is permanent.

For stations on streams with permanent beds the first step in computing the run-off is the construction of the rating table, which shows the discharge corresponding to any stage of the stream. This rating table is applied to the record of stage to determine the amount of water flowing. The construction of the rating table depends on the method used in measuring flow.

For a station at a weir or dam the basis for the rating table is some standard weir formula. The coefficients to be used in its application depend on the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and assumed coefficient, the discharge is computed for various heads and the rating table constructed.

The data necessary for the construction of a rating table for a velocity-area station are the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross section, the mean velocity of the current, and the quantity of water flowing. A thorough knowledge of the conditions at and in the vicinity of the station is also necessary.

The construction of the rating table depends on the following laws of flow for open, permanent channels: (1) The discharge will remain constant so long as the conditions at or near the gaging station remain constant; (2) the discharge will be the same whenever the stream is at a given stage if the change of slope due to the rise and fall of the stream be neglected; (3) the discharge is a function of and increases gradually with the stage.

The plotting of the results of the various discharge measurements, using gage heights as ordinates, and discharge, mean velocity, and area as abscissas, will define curves which show the discharge, mean velocity, and area corresponding to any gage height. For the development of these curves there should be, therefore, a sufficient number of discharge measurements to cover the range of the stage of the stream. Fig. 2 shows a typical rating curve, with its corresponding mean-velocity and area curves.

As the discharge is the product of two factors, the area and the mean velocity, any change in either factor will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is always concave toward the horizontal axis or on a stra ht line, unless the banks of the stream are overhanging.

The form of the mean-velocity curve depends chiefly upon the surface slope, the roughness of the bed, and the cross section of the stream. Of these the slope is the principal factor. In accordance with the relative change of these factors the curve may be either a straight line, convex or concave toward either axis, or a combination of the three. From a careful study of the conditions at any gaging station the form which the vertical velocity-curve will take can be predicted, and it may be extended with reasonable certainty to stages beyond the limits of actual measurements. Its principal use is in connection with the area curve in locating errors in discharge measurements and in constructing the rating table.

The discharge curve is defined primarily by the measurements of discharge, which are studied and weighted in accordance with the local conditions existing at the time of each measurement. The curve may, however, best be located between and beyond the measurements by means of curves of area and mean velocity. This curve under normal conditions is concave toward the horizontal axis and is generally parabolic in form.

In the preparation of the rating table the discharge for each tenth or half tenth on the gage is taken from the curve. The differences between successive discharges are then taken and adjusted according to the law that they shall either be constant or increasing.

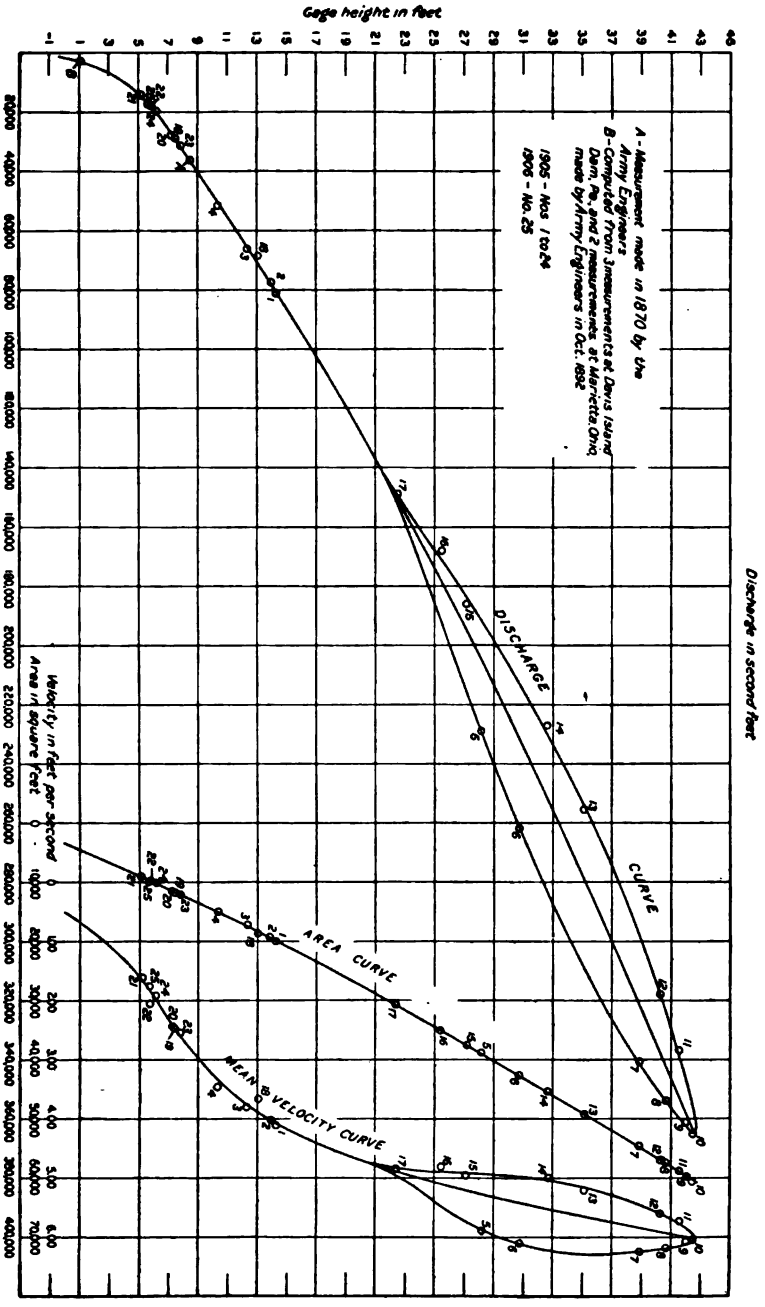


FIG. 2.—Rating, discharge, area, and mean-velocity curves for Ohio River at Wheeling, W. Va.

Monthly discharge of Allegheny River at Kittanning, Pa., for 1906.

[Drainage area, 8,660 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	54,300	11,100	25,000	2.88	3.32
February	15,100	5,800	7,940	.914	.95
March	62,100	5,520	16,000	1.84	2.12
April	55,800	9,160	27,800	3.20	3.57
May [a]	18,900	6,100	10,600	1.22	1.41
June [a]	30,700	2,780	6,600	.760	.85
July	2,410	1,650	2,070	.238	.27
August	23,500	1,740	6,200	.713	.82
September	4,960	1,740	2,890	.333	.37
October	23,000	2,410	13,600	1.57	1.81
November	35,300	7,740	16,400	1.89	2.11
December	60,500	9,540	24,900	2.87	3.31
The year	62,100	1,650	13,300	1.54	20.91

[a] Discharge interpolated May 21, 22, and 24 and June 4.

NOTE.—Values for 1906 are excellent.

BLACKLICK CREEK AT BLACKLICK, PA.

This station was established August 16, 1904, and was discontinued July 15, 1906. It was located at the covered wooden highway bridge one-fourth mile from the railway station at Blacklick, Pa. During September, 1905, this bridge was torn down and replaced. The gage was read once each day by Mark Maynard until April 17, after which D. J. Walling was the observer. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 32, where are given also references to publications that contain data for previous years.

The following discharge measurement was made from the new bridge May 23, 1906:

Width, 210 feet; area, 373 square feet; gage height, 2.40 feet; discharge, 118 second-feet.

Daily gage height, in feet, of Blacklick Creek at Blacklick, Pa., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	4.1	3.3	3.3	6.2	2.2	2.0	17	3.8	2.1	3.3	3.7	2.4	2.05
2	3.8	.....	4.2	7.3	3.7	1.9	18	4.1	.....	3.2	3.6	2.3	1.98
3	4.0	.....	5.4	4.6	4.1	1.88	19	4.6	.....	3.3	3.4	2.1	2.02
4	6.2	.....	4.2	4.2	3.6	1.85	20	4.1	.....	3.1	3.2	2.0	2.0
5	5.0	.....	3.5	4.6	3.2	1.8	21	4.2	2.8	3.1	3.2	2.0	1.95
6	4.6	.....	3.1	5.4	3.0	2.15	22	4.3	3.7	3.0	3.1	2.0	1.82
7	4.0	.....	3.4	5.3	2.9	3.4	23	6.2	3.2	2.7	2.9	1.9	4.2
8	3.9	.....	3.3	6.2	2.7	2.8	24	5.3	3.1	2.7	2.8	1.9	3.5
9	3.5	.....	3.5	7.6	2.7	2.4	25	4.7	3.3	2.9	2.7	1.8	3.0
10	3.4	.....	3.4	.....	2.7	2.3	26	4.2	3.4	4.3	2.6	1.8	2.8
11	3.6	.....	3.3	.....	2.6	2.75	27	3.8	3.4	7.1	2.5	2.5	2.5
12	3.6	.....	3.2	4.2	2.5	2.4	28	3.7	3.3	7.2	2.5	2.8	2.[illegible]
13	3.8	.....	3.1	3.7	2.5	2.15	29	3.6	.....	5.1	2.4	2.5	2.15
14	3.4	4.3	3.3	4.6	2.5	2.08	30	3.4	.....	6.2	2.2	2.1	2.02
15	3.4	.....	3.2	4.7	2.5	2.1	31	3.4	.....	7.8	.....	2.0	.....
16	3.9	.....	3.2	4.5	2.4	2.0							

NOTE.—Creek frozen February 2 to 20; ice attained a thickness of about 0.5 foot; see footnote to monthly discharge table.

Rating table for Blacklick Creek at Blacklick, Pa., for 1904 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	21	3.00	354	4.20	1,327	5.80	3,310
1.90	35	3.10	403	4.30	1,432	6.00	3,590
2.00	51	3.20	460	4.40	1,540	6.20	3,870
2.10	69	3.30	525	4.50	1,650	6.40	4,160
2.20	89	3.40	597	4.60	1,765	6.60	4,450
2.30	112	3.50	676	4.70	1,880	6.80	4,740
2.40	138	3.60	759	4.80	2,000	7.00	5,040
2.50	167	3.70	846	4.90	2,120	7.20	5,340
2.60	199	3.80	936	5.00	2,245	7.40	5,650
2.70	233	3.90	1,029	5.20	2,500	7.60	5,970
2.80	270	4.00	1,125	5.40	2,765	7.80	6,290
2.90	310	4.10	1,224	5.60	3,035		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 11 discharge measurements made during 1904–6. It is fairly well defined between gage heights 1.8 feet and 5.0 feet. The table may be somewhat in excess of the true values, owing to a change in the conditions of flow during the erection of the new bridge in the latter part of 1905. Two measurements made at the new bridge give values that are nearly 15 per cent lower than the rating.

Monthly discharge of Blacklick Creek at Blacklick, Pa., for 1906.

[Drainage area, 403 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	3,870	597	1,310	3.25	3.75
February 21-28	846	270	528	1.31	.39
March	6,290	233	1,300	3.23	3.72
April	5,970	89	1,640	4.07	4.54
May	1,220	21	227	.563	.65
June	1,330	21	178	.442	.49

NOTE.—Values for January, February, and March, good; from February 2 to 20 the flow probably varied from about 200 to 400 sec.-ft.; values for April, May, and June are probably considerably too low, owing to inexperience of new observer, who was appointed April 12.

MONONGAHELA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Monongahela River is formed near Fairmont, Marion County, in the northern part of West Virginia, by the union of its West Fork with Tygarts Valley River. The headwaters of the latter stream lie on the slopes and in the valleys of the Appalachian Mountains near the eastern boundary of West Virginia; thence they flow northward, draining a hilly and mountainous country. West Fork has its headwaters west of those of Tygarts Valley River, in the central part of West Virginia; thence they flow northward, draining a hilly country.

The principal tributaries of Monongahela River below Fairmont are Cheat and Youghiogheny rivers, both entering from the east. Cheat River drains a rugged, mountainous district in northern West Virginia and flows into Monongahela River near Point Marion, Pa. Youghiogheny River drains a mountainous district of Maryland and Pennsylvania and enters the Monongahela about 15 miles above

Pittsburg. The basins of all these tributary rivers have steep slopes and collect and discharge their waters quickly, with the result that the Monongahela is liable to the excessive freshets for which it is noted. The whole basin was once heavily timbered, but has been thoroughly cleared except about the upper waters of the principal streams. Little water power is used in the basin. Navigation extends to Fairmont.

YOUGHIOGHENY RIVER NEAR CONFLUENCE, PA.

This station was established September 15, 1904. It is located at the highway bridge about one-half mile from the railway station at Confluence, Pa. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 40, where are given also references to publications that contain data for previous years.

The following discharge measurement was made May 25, 1906:

Width, 188 feet; area, 163 square feet; gage height, 1.86 feet; discharge, 200 second-feet.

Daily gage height, in feet, of Youghiogheny River near Confluence, Pa., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.6	2.6	2.5	6.1	3.1	2.45	2.45	2.2	1.9	1.8	2.1	2.3
2	2.5	2.5	2.5	5.1	3.3	2.5	2.4	2.1	1.9	1.75	2.2	2.3
3	2.85	2.45	2.5	4.8	3.2	2.35	2.2	2.4	1.8	1.75	1.95	2.65
4	5.35	2.4	2.75	4.8	3.0	2.25	2.15	2.1	1.8	1.85	1.8	2.5
5	4.4	2.35	3.4	5.2	2.9	2.2	2.15	2.0	1.75	2.1	1.8	2.35
6	3.7	2.25	3.2	7.0	2.8	4.4	2.1	1.9	1.7	2.2	1.85	3.3
7	3.3	2.15	3.0	5.5	2.7	5.2	2.0	1.9	1.7	2.35	1.8	4.1
8	3.2	1.9	2.85	4.5	2.6	3.9	1.95	4.4	1.65	2.25	1.75	3.5
9	2.7	1.9	2.75	4.4	2.6	3.35	1.9	7.4	1.65	2.1	1.75	3.1
10	2.5	1.95	2.75	5.75	2.6	2.9	1.9	8.2	1.8	2.05	1.8	6.4
11	2.7	2.0	2.8	4.8	2.55	2.7	1.85	5.1	1.8	2.0	1.8	8.1
12	3.3	2.0	2.85	4.1	2.5	2.6	1.85	3.9	1.6	2.0	1.85	5.55
13	2.7	2.15	2.75	3.8	2.4	2.5	1.8	3.4	1.65	1.95	1.8	4.4
14	2.7	2.1	2.7	3.6	2.3	2.4	1.8	3.0	2.0	1.95	1.8	3.95
15	2.75	2.05	2.75	5.2	2.25	2.35	1.75	2.8	1.8	1.9	1.85	3.65
16	2.85	2.05	2.75	4.7	2.2	2.25	1.75	2.55	1.7	1.9	1.9	4.2
17	3.55	2.0	2.7	4.1	2.15	2.15	1.75	2.55	1.65	1.85	2.0	5.85
18	3.8	2.05	2.65	3.7	2.1	2.1	1.8	2.5	1.95	1.85	3.0	6.4
19	4.35	2.1	2.7	3.4	2.1	2.05	1.7	2.7	1.9	1.85	3.5	4.8
20	3.8	2.2	2.75	3.1	2.05	2.3	1.7	3.6	1.9	2.0	4.4	4.1
21	3.8	2.2	2.6	3.1	2.0	3.1	1.7	4.0	1.85	2.3	4.0	3.9
22	3.85	2.4	2.5	3.2	2.0	2.9	1.8	3.15	1.85	2.4	3.35	3.6
23	10.0	2.65	2.5	3.35	1.95	2.8	2.8	2.7	1.85	2.3	2.9	3.25
24	6.4	2.6	2.8	3.4	1.9	2.8	2.4	2.6	1.8	2.15	2.7	3.0
25	4.8	2.45	3.0	3.4	1.85	2.6	2.2	2.6	1.8	2.05	2.55	2.8
26	4.0	2.3	2.7	3.4	1.85	2.5	2.0	2.35	1.75	1.95	2.45	2.8
27	3.5	2.3	5.5	4.65	1.8	2.5	1.8	2.35	1.75	1.95	2.35	2.85
28	3.3	2.35	8.0	3.9	2.3	2.45	1.75	2.25	1.7	1.9	2.3	3.5
29	3.1	.....	6.4	3.5	2.35	2.75	1.7	2.15	1.7	1.95	2.25	4.9
30	2.9	.....	7.7	3.25	2.3	2.5	2.5	2.1	1.8	2.05	2.2	5.35
31	2.8	.....	8.6	.....	2.4	.....	2.3	2.0	.....	2.1	.....	7.5

NOTE.—Discharge probably unaffected by ice conditions.

Rating table for Youghiogheny River near Confluence, Pa., for 1904 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.60	118	2.90	896	4.20	2,125	6.00	4,460
1.70	156	3.00	974	4.30	2,237	6.20	4,760
1.80	199	3.10	1,055	4.40	2,351	6.40	5,070
1.90	247	3.20	1,139	4.50	2,467	6.60	5,390
2.00	299	3.30	1,226	4.60	2,585	6.80	5,710
2.10	354	3.40	1,316	4.70	2,605	7.00	6,040
2.20	412	3.50	1,407	4.80	2,727	7.20	6,375
2.30	473	3.60	1,501	4.90	2,851	7.40	6,715
2.40	537	3.70	1,598	5.00	3,077	7.60	7,065
2.50	604	3.80	1,698	5.20	3,337	7.80	7,420
2.60	674	3.90	1,801	5.40	3,604	8.00	7,780
2.70	746	4.00	1,907	5.60	3,880	9.00	9,620
2.80	820	4.10	2,015	5.80	4,166	10.00	11,510

NOTE.—The above table is applicable only for open-channel conditions. It is based on 12 discharge measurements made during 1904-1906. It is well defined between gage heights 1.3 feet and 7.0 feet. Above gage height 4.0 feet the discharge values in this table may occasionally be too great on account of backwater from Casselman River.

Monthly discharge of Youghiogheny River near Confluence, Pa., for 1906.

[Drainage area, 435 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	11,500	604	1,800	4.14	4.77
February	710	247	436	1.00	1.04
March	8,880	604	1,720	3.95	4.55
April	6,040	1,060	2,320	5.33	5.95
May	1,230	199	554	1.27	1.46
June	3,340	326	822	1.89	2.11
July	820	156	310	.713	.82
August	8,140	247	1,270	2.92	3.37
September	299	118	193	.444	.50
October	537	178	313	.720	.83
November	2,350	178	553	1.27	1.42
December	7,960	473	2,250	5.17	5.96
The year	11,500	118	1,050	2.40	32.78

NOTE.—Values for 1906 are excellent. Above gage height 4.0 feet there is occasionally backwater from Casselman River. With the data at hand it has been impossible to detect the time of occurrence of this condition, hence the rating for free flow has been used for all stages.

CASSELMAN RIVER AT CONFLUENCE, PA.

This station was established September 15, 1904. It is located at the highway bridge in Confluence, Pa., about 500 yards from the railroad station. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 43, where are given also references to publications that contain data for previous years.

The following discharge measurement was made May 25, 1906:

Width, 212 feet; area, 166 square feet; gage height, 1.87 feet; discharge, 175 second-feet.

Daily gage height, in feet, of Casselman River at Confluence, Pa., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.5	2.5	2.0	5.2	2.5	2.05	1.8	2.0	2.1	1.9	2.0	2.2
2	2.45	2.35	2.15	4.5	2.7	2.1	1.9	1.95	2.15	2.0	2.0	2.15
3	2.7	2.45	2.35	4.4	2.75	2.05	1.8	3.85	2.1	1.95	1.9	2.3
4	4.55	2.3	2.9	4.5	2.6	2.05	1.85	2.8	2.0	1.9	1.8	2.2
5	3.7	2.45	2.7	4.9	2.6	2.0	1.8	2.4	1.95	2.1	1.8	2.2
6	3.05	2.3	2.5	6.5	2.45	4.1	1.75	2.15	1.9	2.1	1.8	3.35
7	2.65	2.2	2.6	4.7	2.5	4.9	1.75	2.5	1.85	2.2	1.75	3.6
8	2.8	2.1	2.55	3.85	2.4	3.35	1.7	4.65	1.8	2.1	1.75	2.85
9	2.5	2.0	2.55	3.9	2.3	2.7	1.6	7.8	1.8	1.95	1.75	2.7
10	2.25	2.05	2.5	5.05	2.45	2.4	1.6	8.8	2.0	1.9	1.75	6.5
11	2.65	2.05	2.45	4.2	2.35	2.25	1.65	4.9	2.0	1.9	1.8	7.1
12	2.6	2.1	2.7	3.6	2.2	2.2	1.6	3.65	1.8	1.85	1.8	4.5
13	2.6	2.15	2.6	3.3	2.25	2.15	1.6	3.2	1.85	1.85	1.85	3.65
14	2.5	2.0	2.6	3.1	2.25	2.1	1.6	2.8	2.0	1.85	1.85	3.35
15	2.45	2.1	2.6	4.7	2.1	2.1	1.6	2.6	2.0	1.8	1.9	3.2
16	2.65	2.1	2.45	4.0	2.15	2.05	1.6	2.45	1.9	1.8	1.9	3.8
17	2.9	2.05	2.55	3.5	2.15	2.05	1.6	2.45	1.75	1.8	1.95	5.05
18	3.3	2.05	2.5	3.2	2.0	2.0	1.7	2.4	1.9	1.8	2.7	5.1
19	3.85	2.0	2.5	3.0	2.1	2.0	1.7	3.6	1.9	1.8	3.1	3.55
20	3.15	2.1	2.45	2.8	2.05	2.1	1.65	4.0	1.85	2.6	3.25	3.4
21	3.2	2.2	2.35	3.1	1.95	2.4	1.6	4.1	1.8	2.45	2.9	3.2
22	3.3	2.7	2.4	2.15	2.0	2.2	1.75	3.3	1.8	2.35	2.6	3.0
23	9.9	2.3	2.35	3.25	1.95	2.25	2.6	2.95	1.75	2.25	2.4	2.75
24	4.7	2.2	2.3	3.1	1.8	2.15	2.15	2.7	1.75	2.15	2.35	2.6
25	4.1	2.25	2.35	2.9	1.85	2.05	1.9	2.9	1.7	2.05	2.3	2.5
26	3.5	2.25	2.3	3.2	1.85	2.0	1.75	2.65	1.7	2.0	2.25	2.5
27	3.2	2.2	4.8	3.2	1.8	1.95	1.75	2.6	1.75	2.0	2.2	2.6
28	3.05	2.15	7.4	2.8	2.1	1.9	1.7	2.55	1.8	2.0	2.2	2.9
29	2.9	.....	5.6	2.85	2.15	1.9	1.7	2.4	1.7	2.05	2.15	4.0
30	2.65	.....	7.0	2.5	2.1	1.8	1.9	2.3	1.75	2.0	2.1	4.7
31	2.7	.....	7.7	.....	2.1	.....	2.0	2.2	.....	2.0	.....	7.5

NOTE.—Discharge probably unaffected by ice conditions during 1906.

Rating table for Casselman River at Confluence, Pa., for 1904 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.60	58	2.30	491	3.00	1,175	3.70	1,935
1.70	95	2.40	579	3.10	1,281	3.80	2,045
1.80	141	2.50	671	3.20	1,388	3.90	2,155
1.90	196	2.60	767	3.30	1,496	4.00	2,265
2.00	260	2.70	866	3.40	1,605		
2.10	331	2.80	967	3.50	1,715		
2.20	408	2.90	1,070	3.60	1,825		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 12 discharge measurements made during 1904-1906. It is well defined between gage heights 1.5 feet and 4 feet. Owing to frequent backwater from Youghiogheny River the discharge values for higher gage heights are liable to be in considerable error.

Monthly discharge of Casselman River at Confluence, Pa., for 1906.

[Drainage area, 450 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	10,000	450	1,510	3.36	3.87
February	866	260	417	.927	.97
March	6,500	200	1,270	2.82	3.25
April	5,200	370	1,970	4.38	4.89
May	916	141	435	.967	1.11
June	3,500	141	560	1.24	1.38
July	767	58	139	.309	.36
August	9,500	228	1,650	3.67	4.23
September	370	95	186	.413	.46
October	767	141	282	.627	.72
November	1,440	118	395	.878	.98
December	7,600	370	1,890	4.20	4.84
The year	10,000	58	892	1.98	27.06

NOTE.—Values are rated as follows: Monthly means, excellent; discharge above gage height 5.0 feet, fair.

Above gage height 4.0 feet there is frequently backwater at this station from the Youghiogheny River. No rating table has been used for these stages, and the daily discharge values are based on the study of the relative gage heights on Casselman and Youghiogheny rivers. This study shows that there is sometimes free flow at the Casselman station, but more often backwater.

LAUREL HILL CREEK AT CONFLUENCE, PA.

This station was established September 15, 1904. It is located at the highway bridge near the tannery, about one-fourth mile from the railroad station at Confluence, Pa. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 45, where are given also references to publications that contain data for previous years.

The following discharge measurement was made May 26, 1906:

Width, 82 feet; area, 116 square feet; gage height, 1.96 feet; discharge, 53 second-feet.

Daily gage height, in feet, of Laurel Hill Creek at Confluence, Pa., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.55	2.3	2.5	3.6	2.3	2.1	1.95	1.85	2.05	1.95	1.8	2.3
2	2.45	2.25	2.5	3.3	2.5	2.05	1.9	1.85	2.05	2.1	1.8	2.3
3	2.7	2.25	2.5	3.4	2.6	1.95	1.85	2.0	2.1	2.0	1.8	2.5
4	4.0	2.3	2.6	3.5	2.4	1.85	1.9	2.0	2.0	1.9	1.8	2.4
5	3.2	2.3	2.5	3.8	2.35	1.8	1.85	1.9	1.9	2.0	1.8	2.35
6	2.85	2.25	2.5	4.6	2.3	3.2	1.8	1.8	1.9	2.1	1.75	3.9
7	2.65	2.25	2.5	3.5	2.3	3.5	1.8	4.0	1.85	2.3	1.75	3.65
8	2.7	2.2	2.5	3.15	2.25	3.0	1.8	3.8	1.8	2.1	1.75	2.9
9	2.5	2.2	2.5	3.3	2.35	2.5	1.8	4.8	1.8	1.95	1.75	2.7
10	2.3	2.25	2.4	3.75	2.4	2.4	1.8	5.9	2.15	1.95	1.7	5.5
11	2.25	2.2	2.5	3.3	2.35	2.25	1.75	3.6	2.0	1.9	1.8	5.1
12	2.4	2.15	2.6	3.0	2.3	2.2	1.75	2.95	1.75	1.9	1.8	3.55
13	2.35	2.15	2.5	2.45	2.3	2.2	1.7	2.7	1.8	1.85	1.8	3.1
14	2.3	2.15	2.5	2.1	2.25	2.2	1.7	2.45	1.8	1.85	1.8	3.0
15	2.35	2.1	2.5	3.6	2.25	2.15	1.75	2.35	2.0	1.8	1.8	2.9
16	2.45	2.1	2.45	2.9	2.2	2.1	1.75	2.25	1.85	1.8	1.9	2.85
17	2.55	2.1	2.45	2.75	2.2	2.05	1.7	2.25	1.75	1.8	2.0	3.55
18	2.9	2.05	2.4	2.65	2.2	2.0	1.9	2.4	1.7	1.8	3.0	3.2
19	3.05	2.05	2.4	2.6	2.15	2.0	2.0	3.45	1.7	1.8	3.4	2.8
20	2.75	2.05	2.35	2.5	2.1	2.0	1.85	3.3	1.65	1.95	2.95	2.8
21	2.9	2.3	2.35	2.6	2.05	2.1	1.7	3.25	1.8	2.1	2.75	2.7
22	2.9	2.75	2.4	2.65	2.0	2.1	1.9	2.95	1.75	1.9	2.6	2.6
23	7.0	2.6	2.35	2.8	2.0	2.3	2.7	2.75	1.75	1.85	2.35	2.55
24	3.75	2.5	2.3	2.75	1.95	2.25	2.35	2.6	1.7	1.85	2.3	2.5
25	3.15	2.45	2.3	2.7	1.95	2.1	2.1	2.5	1.75	1.8	2.3	2.45
26	2.85	2.4	2.45	2.7	1.95	2.0	2.0	2.4	1.75	1.75	2.25	2.45
27	2.7	2.35	3.6	2.6	2.05	2.05	1.95	2.3	1.75	1.75	2.2	2.55
28	2.6	2.3	5.0	2.5	2.7	2.0	1.9	2.25	1.8	1.85	2.2	3.1
29	2.5	.....	3.8	2.4	2.35	2.0	1.9	2.2	1.75	1.85	2.15	3.05
30	2.45	.....	4.7	2.4	2.25	1.95	2.0	2.15	1.8	1.85	2.1	3.45
31	2.4	.....	5.4	.....	2.15	.....	1.9	2.1	.....	1.8	.....	5.0

NOTE. Discharge probably unaffected by ice conditions during 1906.

Rating table for Laurel Hill Creek at Confluence, Pa., for 1904 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.60	7	2.10	93	2.50	266	2.90	503
1.70	13	2.20	128	2.60	321	3.00	568
1.80	24	2.30	169	2.70	379	3.10	634
1.90	41	2.40	215	2.80	440	3.20	701
2.00	64						

The above table is applicable only for open-channel conditions. It is based on 13 discharge measurements made during 1904-1906. It is well defined between gage heights 1.8 feet and 3.2 feet. Above gage height 3.2 feet the discharge values are usually more or less in error on account of backwater from Casselman and Youghiogheny rivers.

Monthly discharge of Laurel Hill Creek at Confluence, Pa., for 1906.

[Drainage area, 118 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	2,800	148	467	3.96	4.56
February	410	78	159	1.35	1.41
March	2,000	169	446	3.78	4.36
April	1,600	93	582	4.93	5.50
May	379	52	153	1.30	1.50
June	950	24	170	1.44	1.61
July	379	13	51.8	.439	.51
August	2,000	24	445	3.77	4.35
September	110	10	35.3	.299	.33
October	169	18	47.4	.402	.46
November	800	13	142	1.20	1.34
December	2,000	169	613	5.19	5.98
The year	2,800	10	276	2.34	31.91

NOTE.—Values are rated as follows: Monthly means, excellent; discharge above gage height 3.5 feet, fair. Above gage height 3.2 feet there is usually backwater at this station from Youghiogheny and Casselman rivers. No rating table has been used for these stages, the daily discharge values being based on the relative run-off from the Casselman and Youghiogheny river drainage basins for low stages.

BEAVER RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Beaver River is formed by the junction of Mahoning and Shenango rivers just below Newcastle, Pa. Mahoning River flows through a hilly and important territory. There are numerous water-power developments on it, and it forms an important adjunct in the water supply and sewage disposal of many towns along its course.

MAHONING RIVER AT YOUNGSTOWN, OHIO.

This station was established May 23, 1903, and was discontinued July 23, 1906. It is located about 2 miles below the center of the city of Youngstown, Ohio, at the highway bridge near the plant of the Hazleton Steel Company. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 48, where are given also references to publications that contain data for previous years.

Discharge measurements of Mahoning River at Youngstown, Ohio, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 7	E. F. Kriegsman	160	655	2.67	1,410
May 14	do	153	391	1.19	298

Mean daily gage height, in feet, of Mahoning River near Youngstown, Ohio, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	1.7	1.35	1.8	5.55	1.0	0.8	0.85
2	1.55	1.15	4.8	3.75	.95	.8	.8
3	1.7	1.2	4.2	2.65	.9	.75	.75
4	4.35	1.1	4.5	2.2	.95	.85	.7
5	5.55	1.05	4.8	1.85	3.75	.7	.85
6	3.4	1.0	4.2	2.2	3.95	.7	.8
7	2.05	.95	3.5	2.1	3.7	.75	.75
8	1.9	1.0	2.4	2.25	2.2	.7	.75
9	1.6	.9	2.35	2.4	2.05	1.0	.7
10	1.45	.8	2.0	3.15	1.9	.9	.8
11	1.25	.75	1.85	4.35	1.65	.95	.9
12	1.25	.7	1.35	3.35	1.45	.9	1.1
13	1.15	.8	1.75	2.85	1.4	.9	1.2
14	1.05	.85	1.7	2.35	1.15	.85	1.4
15	1.1	1.2	1.7	2.2	1.2	1.0	1.45
16	1.7	1.4	1.6	2.15	1.1	.95	1.25
17	2.05	1.35	1.45	2.05	1.1	.8	1.15
18	2.4	1.3	1.4	1.9	1.05	.75	1.05
19	2.95	1.2	1.55	1.8	1.0	.8	1.0
20	3.15	1.15	1.35	1.7	1.05	.95	.95
21	3.65	1.5	1.3	1.65	1.0	.85	.85
22	3.4	2.1	1.45	1.5	.95	.85	.9
23	3.15	2.5	1.35	1.3	.95	.8	.85
24	3.8	2.45	1.5	1.3	.9	.8	.....
25	2.5	2.65	1.65	1.25	.85	.75	.....
26	2.0	2.0	1.7	1.2	.8	.75	.....
27	1.7	1.75	9.2	1.2	.7	.8	.....
28	1.55	1.45	11.55	1.15	.7	.85	.....
29	1.45	.....	11.4	1.2	.75	.9	.....
30	1.3	.....	8.3	1.1	.8	.85	.....
31	1.25	.....	6.45	.....	.75	.....	.....

NOTE.—No ice conditions at this station.

Rating table for Mahoning River at Youngstown, Ohio, for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.70	113	2.10	938	3.50	2,110	5.80	4,630
.80	151	2.20	1,014	3.60	2,210	6.00	4,870
.90	195	2.30	1,091	3.70	2,310	6.20	5,130
1.00	244	2.40	1,170	3.80	2,410	6.40	5,390
1.10	296	2.50	1,250	3.90	2,510	6.60	5,650
1.20	350	2.60	1,330	4.00	2,610	6.80	5,910
1.30	406	2.70	1,410	4.20	2,810	7.00	6,180
1.40	464	2.80	1,490	4.40	3,030	8.00	7,580
1.50	524	2.90	1,575	4.60	3,250	9.00	9,080
1.60	586	3.00	1,660	4.80	3,470	10.00	10,600
1.70	651	3.10	1,745	5.00	3,690	11.00	12,200
1.80	719	3.20	1,830	5.20	3,910	12.00	13,900
1.90	790	3.30	1,920	5.40	4,150		
2.00	863	3.40	2,010	5.60	4,390		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 22 discharge measurements made during 1903-1906. It is fairly well defined between gage heights 0.9 foot and 2.5 feet. The table beyond these limits is based on 1 measurement at 7.8 and 1 at 10.8 feet, the latter being recomputed by the use of low-water soundings. Below 0.9 foot the curve is unsatisfactory, probably owing to the influence of the dam below, as at low stages the water may fall below the crest.

Monthly discharge of Mahoning River at Youngstown, Ohio, for 1906.

[Drainage area, 958 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	4,330	270	1,120	1.17	1.35
February	1,370	113	463	.483	.50
March	13,100	406	2,560	2.67	3.08
April	4,330	296	1,080	1.13	1.26
May	2,560	113	552	.576	.66
June	244	113	167	.174	.19
July 1-23	494	113	228	.238	.20

NOTE.—Values are rated as follows: January to May, good; June to July, fair.

MUSKINGUM RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Muskingum River is formed by the junction of Walhonding and Tuscarawas rivers in the east-central part of Ohio, flows southward, and enters Ohio River at Marietta, Ohio. The river is navigable below Zanesville, and the dams which were built as an aid to navigation are used for water power. There are good reservoir sites on some of the tributaries, and these could be used for storing water to augment the low-water flow. The records of the stations in this basin are of value accordingly.

MUSKINGUM RIVER AT ZANESVILLE, OHIO.

This station was established March 11, 1905. It is located at the Sixth Street Bridge, Zanesville, Ohio, 1,000 feet above the lowest lock which is maintained by the War Department, which furnishes the gage heights. It is about 3,000 feet below a dam and about the same distance below the entrance of Licking River, which also has a dam near its mouth. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 50.

Discharge measurements of Muskingum River at Zanesville, Ohio, in 1905 and 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 11	R. W. Pratt	531	6,270	16.85	25,800
March 16	do	510	2,840	9.75	6,410
March 16	E. C. Murphy	501	2,660	9.83	6,300
May 21	M. S. Brennan	472	2,920	10.50	8,420
June 13	S. K. Clapp	489	4,680	13.20	17,400
July 9	do		2,470	9.20	5,630
August 28	R. W. Pratt	475	2,280	8.70	3,640
October 30	do	495	2,180	8.60	2,930
November 14	do		2,280	8.75	3,500
1906.					
February 12[a]	Brennan and Kriegsman	469	1,810	8.35	2,310
March 5	E. F. Kriegsman	415	3,430	11.92	12,900
April 9	do	493	3,340	11.00	9,080
May 22	do	485	1,980	8.20	2,350
June 6	Murphy and Kriegsman	487	2,000	7.90	1,720

[a] Ice along shores at time of this measurement.

Daily gage height, in feet, of Muskingum River at Zanesville, Ohio, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	9.8	9.0	9.0	21.2	9.5	8.0	8.2	8.5	8.1	8.4	8.5	9.0
2	9.3	8.9	8.8	19.0	9.2	8.0	8.0	8.2	8.0	8.6	8.4	8.8
3	9.5	8.5	9.3	16.95	9.1	8.0	7.9	8.0	8.1	9.0	8.4	8.9
4	13.1	8.4	11.8	14.8	9.1	7.9	8.0	7.9	8.1	8.6	8.3	8.8
5	14.25	8.7	11.85	13.0	9.0	7.8	8.1	7.8	8.8	8.8	8.3	8.6
6	14.2	8.55	11.1	12.35	8.8	7.8	8.1	7.7	8.7	8.5	8.2	9.3
7	13.4	8.3	11.1	12.0	8.9	7.8	8.0	7.7	8.3	8.8	8.1	12.05
8	11.2	8.4	9.9	11.87	8.9	8.1	8.0	8.4	8.0	9.0	8.1	13.1
9	9.9	8.4	9.8	11.1	8.8	8.1	8.3	10.2	7.8	9.5	8.1	12.25
10	9.2	8.5	9.7	10.9	8.7	8.0	8.2	9.9	7.9	9.5	8.2	11.6
11	9.4	8.2	9.5	10.9	8.6	7.9	8.1	10.1	7.9	9.2	8.1	11.8
12	9.6	8.3	9.4	10.8	8.6	7.8	8.1	9.7	7.8	9.3	8.1	11.9
13	9.4	8.5	9.4	10.3	8.5	7.7	7.9	9.2	7.8	9.1	8.1	11.8
14	10.1	8.5	9.2	10.1	8.5	7.7	7.9	8.7	7.8	8.7	8.1	11.2
15	11.0	8.4	9.2	10.4	8.5	7.7	7.8	8.4	7.6	8.6	8.1	11.2
16	12.9	8.5	9.1	10.6	8.5	7.7	8.1	8.3	7.6	8.4	8.3	14.8
17	13.3	8.6	9.1	10.5	8.4	7.6	8.8	8.0	7.6	8.4	8.3	14.35
18	12.85	8.8	9.0	10.0	8.3	7.8	8.9	8.7	7.8	8.3	8.5	13.45
19	12.2	8.6	9.1	9.7	8.2	7.8	9.3	10.1	7.8	8.5	9.5	12.4
20	11.7	8.5	9.5	9.5	8.1	8.1	9.5	10.5	7.9	9.1	10.4	11.6
21	11.2	8.5	9.8	9.3	8.2	8.2	9.3	10.4	8.0	9.5	11.1	11.0
22	10.9	8.2	10.3	9.1	8.1	8.2	9.5	10.1	8.1	9.7	14.3	10.7
23	10.8	10.0	10.5	9.0	8.0	8.3	9.0	10.1	8.3	9.2	12.4	10.5
24	10.5	10.1	10.1	8.9	8.0	8.6	8.7	10.5	8.1	8.9	12.0	10.0
25	10.2	10.0	9.7	8.9	8.0	8.7	8.5	10.1	8.0	8.7	11.0	9.7
26	9.9	9.9	10.1	9.4	8.0	8.4	8.2	9.6	7.9	8.6	10.4	9.1
27	9.6	9.7	17.55	10.4	7.8	8.1	8.1	9.2	7.8	8.5	9.9	9.1
28	9.3	9.2	23.95	11.2	8.4	8.4	7.9	8.9	7.8	8.4	9.5	10.1
29	9.2	.....	22.4	10.9	8.1	8.0	8.1	8.6	7.9	8.6	9.3	11.2
30	9.1	.....	22.25	10.1	8.0	8.0	8.2	8.4	7.9	8.6	9.1	12.6
31	9.1	.....	23.1	.....	8.0	.....	8.0	8.3	.....	8.6	.....	14.2

NOTE.—Flow slightly affected by ice conditions during February.

Rating table for Muskingum River at Zanesville, Ohio, for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
7.60	1,180	9.10	4,380	10.60	8,370	13.20	17,360
7.70	1,370	9.20	4,620	10.70	8,670	13.40	18,140
7.80	1,560	9.30	4,860	10.80	8,980	13.60	18,920
7.90	1,760	9.40	5,110	10.90	9,290	13.80	19,700
8.00	1,960	9.50	5,360	11.00	9,600	14.00	20,500
8.10	2,160	9.60	5,610	11.20	10,230	15.00	24,600
8.20	2,370	9.70	5,870	11.40	10,870	16.00	29,000
8.30	2,580	9.80	6,130	11.60	11,530	17.00	33,500
8.40	2,790	9.90	6,390	11.80	12,210	18.00	38,000
8.50	3,000	10.00	6,660	12.00	12,900	19.00	42,500
8.60	3,220	10.10	6,930	12.20	13,610	20.00	47,100
8.70	3,440	10.20	7,210	12.40	14,340	21.00	51,700
8.80	3,670	10.30	7,490	12.60	15,080	22.00	56,300
8.90	3,900	10.40	7,780	12.80	15,840	23.00	60,900
9.00	4,140	10.50	8,070	13.00	16,600	24.00	65,600

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905 and 1906. It is well defined between gage heights 7.9 feet and 14.0 feet.

Monthly discharge of Muskingum River at Zanesville, Ohio, for 1905 and 1906.

[Drainage area, 5,820 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
April 9-30	11,500	2,790	5,260	0.902	0.74
May	40,200	2,370	11,200	1.92	2.21
June	25,500	3,220	9,780	1.68	1.87
July	6,660	1,960	3,480	.597	.69
August	21,300	1,270	4,560	.782	.90
September	11,900	1,370	4,280	.734	.82
October	14,300	1,960	4,300	.738	.85
November	15,800	2,370	4,280	.734	.82
December	32,600	3,440	10,800	1.85	2.13
1906.					
January	21,500	4,380	9,590	1.64	1.89
February [a]	6,930	2,370	3,710	.636	.66
March	65,400	3,670	14,300	2.45	2.82
April	52,600	3,900	12,100	2.08	2.32
May	5,360	1,560	2,990	.513	.59
June	3,440	1,180	1,980	.340	.38
July	5,360	1,560	2,720	.467	.54
August	8,070	1,370	4,380	.751	.87
September	3,670	1,180	1,920	.329	.37
October	5,870	2,580	3,760	.645	.74
November	21,700	2,160	5,270	.904	1.01
December	23,800	3,220	10,600	1.82	2.10
The year	65,400	1,180	6,110	1.05	14.29

[a] Values for February, 1906, probably somewhat in excess of the true values, since no correction was made for the effect of ice conditions. The measurement made February 12, 1906, indicated that on that day the flow was 10 per cent less than the flow as given by the open-channel rating.

NOTE.—Values for 1905 and 1906 are excellent, except those for February, 1906, which is good.

LICKING RIVER AT PLEASANT VALLEY, OHIO.

This station was established November 14, 1902, and was discontinued July 21, 1906. It is located at the highway bridge 300 feet north of the railroad station at Pleasant Valley, Ohio, and 9 miles northwest of Zanesville, Ohio. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 52, where are given also references to publications that contain data for previous years. The records at this point are especially valuable because Licking River is a source of possible water supply for Zanesville.

Discharge measurements of Licking River at Pleasant Valley, Ohio, in 1905 and 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 13	R. W. Pratt	95	499	1.70	1,340
February 28	do	122	647	6.00	1,730
March 16	do	80	355	3.13	447
May 22	M. S. Brennan	79	337	2.86	502
June 19	S. K. Clapp	80	317	2.40	391
July 9	do	70	255	1.92	347
August 28	R. W. Pratt	65	242	1.58	114
October 30	do	67	241	2.33	241
November 14	do	69	284	2.32	318
1906.					
March 5	E. F. Kriegsman	79	405	4.05	906
April 9	do	97	452	3.63	919

Daily gage height, in feet, of Licking River at Pleasant Valley, Ohio, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	2.8	2.6	2.3	9.0	2.5	2.1	2.2
2	2.5	2.6	2.3	6.8	2.5	2.6	2.0
3	2.6	2.5	2.5	5.2	2.7	2.3	1.9
4	10.8	2.5	6.5	4.6	2.6	2.1	3.5
5	8.8	2.5	4.6	4.1	2.5	2.0	2.8
6	6.7	3.3	3.4	4.5	2.4	2.1	2.4
7	4.9	2.7	3.2	4.2	2.3	2.0	2.1
8	4.0	2.6	3.1	3.8	2.3	2.0	2.0
9	3.6	2.6	3.1	3.6	2.6	1.9	1.9
10	3.3	2.6	3.0	3.8	2.4	1.9	1.8
11	3.1	.....	2.9	3.7	2.3	1.8	2.1
12	2.8	.....	2.8	3.4	2.2	1.8	1.9
13	2.6	.....	2.7	3.2	2.2	1.8	1.8
14	2.9	.....	2.7	3.1	2.1	1.9	1.8
15	4.4	.....	2.6	4.1	2.1	1.9	1.8
16	8.8	.....	2.6	3.8	2.1	1.8	1.8
17	5.9	.....	2.5	3.4	2.1	2.4	3.0
18	5.0	2.4	2.6	3.1	2.1	2.2	2.9
19	4.4	2.3	2.7	3.0	2.1	2.3	2.4
20	3.9	2.3	2.5	2.9	2.0	2.2	2.1
21	3.7	2.2	3.0	2.8	2.0	2.2	2.0
22	3.5	3.8	3.6	2.7	2.0	2.1	.....
23	3.6	3.3	3.1	2.6	1.9	2.3	.....
24	3.4	3.1	2.7	2.6	1.9	2.1	.....
25	3.1	3.0	2.8	2.5	1.9	1.9	.....
26	2.9	2.9	2.8	2.8	1.9	1.9	.....
27	2.8	2.9	10.3	3.1	1.9	1.8	.....
28	2.7	2.6	16.0	2.8	2.3	5.9	.....
29	2.7	.....	10.2	2.7	2.6	3.1	.....
30	2.6	.....	7.8	2.6	2.4	2.4	.....
31	2.6	.....	10.8	.....	2.2	.....	.....

NOTE.—Ice conditions February 5 to 20; ice attained a thickness of about 0.5 foot.

Rating tables for Licking River at Pleasant Valley, Ohio.

JANUARY 1, 1905, TO MAY 12, 1905.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	54	2.20	230	2.90	470	3.60	760
1.50	66	2.30	260	3.00	510	3.70	810
1.60	81	2.40	290	3.10	550	3.80	860
1.70	99	2.50	320	3.20	590	3.90	910
1.80	120	2.60	350	3.30	630	4.00	960
1.90	143	2.70	390	3.40	670	4.20	1,080
2.00	170	2.80	430	3.50	710	4.40	1,200
2.10	200						

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904 and 1905. It is not well defined. Above gage height 4.4 feet the following rating table should be used.

MAY 13, 1905, TO JULY 21, 1906.[a]

1.40	80	2.30	310	3.20	640	4.20	1,110
1.50	100	2.40	340	3.30	680	4.40	1,210
1.60	120	2.50	370	3.40	720	4.60	1,320
1.70	140	2.60	400	3.50	760	4.80	1,440
1.80	165	2.70	440	3.60	810	5.00	1,560
1.90	190	2.80	480	3.70	860	5.20	1,700
2.00	220	2.90	520	3.80	910	5.40	1,840
2.10	250	3.00	560	3.90	960		
2.20	280	3.10	600	4.00	1,010		

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905. Above gage height 5.0 feet the rating curve is a tangent, the difference being 70 per tenth. All determinations of discharge based on this and the preceding rating table are subject to large errors over periods varying from a few days to several months. This is due to changes in conditions of flow during both high and low stages.

Monthly discharge of Licking River at Pleasant Valley, Ohio, for 1905 and 1906.

[Drainage area, 696 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
January [a]	1,440	50	368	0.529	0.61
February [a]	2,400	50	482	.693	.72
March [a]	5,410	320	1,200	1.72	1.98
April	1,910	170	370	.532	.59
May	5,550	170	987	1.42	1.64
June	2,540	165	595	.855	.95
July	720	80	168	.241	.28
August	2,890	80	357	.513	.59
September	1,770	80	285	.409	.46
October	3,800	120	600	.862	.99
November	2,330	190	549	.789	.88
December	5,200	310	1,020	1.47	1.70
The year	5,550	50	580	.836	11.39
1906.					
January	5,620	370	1,210	1.74	2.01
February	910	200	348	.500	.52
March	9,260	310	1,440	2.07	2.39
April	4,360	370	931	1.34	1.50
May	440	190	289	.415	.48
June	2,190	165	317	.455	.51
July 1-21	760	165	290	.417	.33

[a] Ice conditions January 4-March 2, 1905.

NOTE.—Values for 1905 and 1906 have been corrected for ice conditions during frozen periods. Values for 1905 and 1906 are fair. For relatively short periods the values are frequently only approximate owing to changing conditions of flow.

KANAWHA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Kanawha River, which rises in Watauga, Ashe, and Alleghany counties, N. C., flows northwestward through Virginia and West Virginia and joins Ohio River at Point Pleasant, W. Va. In its upper course it is known as New River. The headwaters lie in the Appalachian Mountains, among the high ridges which form the divides between the drainage basin of this river and Yadkin River on the east and Holston River on the west. The upper tributaries drain narrow valleys of the mountainous region of North Carolina, and their slopes are generally steep and their beds rough. The main river cuts the Allegheny Front just below Pearisburg, Va.; thence the river's course is through a narrow valley of West Virginia over a rough bed with many falls and rapids. The basin is as beautiful and picturesque as any in the eastern part of the United States. The country on its lower courses, through which the Chesapeake and Ohio Railway passes, is noted for its scenic beauty. Below the junction with the Gauley the river is known as the Kanawha.

The principal tributaries of New River are Little River, which empties near Radford, Va., and Greenbrier River, which rises in the eastern part of West Virginia and joins New River at Hinton, W. Va.

NEW RIVER AT RADFORD, VA.

This station was established August 1, 1898, and was discontinued July 15, 1906. It is located at the highway bridge near the Norfolk and Western Railway station. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 54, where are given also references to publications that contain data for previous years. The length of the chain is now 86.95 feet. The following discharge measurement was made June 11, 1906:

Width, 568 feet; area, 1,690 square feet; gage height, 3.6 feet; discharge, 1,970 second-feet.

Daily gage height, in feet, of New River at Radford, Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	4.0	5.1	4.0	6.2	3.9	3.7	3.6
2	3.9	4.9	4.1	5.3	3.9	3.7	3.6
3	4.1	4.9	4.2	4.9	3.8	3.8	3.6
4	6.9	4.5	4.8	4.7	4.2	3.7	3.6
5	6.1	4.3	4.9	4.4	4.1	3.7	3.6
6	5.7	4.7	4.7	4.1	4.5	3.8	3.6
7	5.4	4.5	4.4	4.1	4.6	3.7	3.6
8	4.5	4.3	4.5	4.4	4.3	3.7	3.8
9	4.3	4.4	4.3	4.3	4.3	3.8	3.8
10	4.2	4.3	4.2	4.4	4.1	3.7	3.7
11	3.7	4.2	4.1	4.3	4.0	3.6	3.7
12	3.6	4.2	4.0	4.3	4.0	3.6	3.7
13	4.3	3.8	4.1	4.3	4.0	3.9	3.7
14	4.9	3.7	4.2	4.1	3.8	5.85	3.6
15	4.7	3.8	4.2	4.2	3.8	6.0	3.6
16	4.8	3.7	5.4	4.3	3.9	5.2	.....
17	4.7	3.7	5.6	5.2	3.7	5.0	.....
18	4.5	3.8	4.7	4.8	3.7	4.9	.....
19	4.5	3.7	4.4	4.6	3.8	4.8	.....
20	4.2	4.0	4.5	4.4	3.7	4.6	.....
21	4.2	4.1	5.0	4.3	3.7	4.9	.....
22	4.2	3.9	4.4	4.2	3.8	4.3	.....
23	8.2	4.2	4.5	4.1	3.7	4.0	.....
24	10.3	4.3	4.4	4.0	3.7	4.0	.....
25	7.1	4.1	4.4	4.1	3.8	4.0	.....
26	6.6	4.0	4.4	3.7	3.7	3.8	.....
27	5.9	4.1	4.4	3.9	3.7	3.8	.....
28	6.0	4.0	4.8	3.8	4.0	3.8	.....
29	5.5	.....	4.7	3.8	3.9	3.8	.....
30	5.4	.....	4.4	3.8	3.9	3.7	.....
31	5.2	.....	6.8	.....	3.8	.....	.....

NOTE.—Discharge not affected by ice conditions during 1906.

Rating table for New River at Radford, Va., for 1898 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.60	2,160	4.90	6,380	6.20	11,610	8.00	19,920
3.70	2,430	5.00	6,770	6.30	12,040	8.20	20,990
3.80	2,710	5.10	7,160	6.40	12,470	8.40	22,100
3.90	3,000	5.20	7,550	6.50	12,900	8.60	23,250
4.00	3,290	5.30	7,940	6.60	13,340	8.80	24,440
4.10	3,590	5.40	8,340	6.70	13,780	9.00	25,650
4.20	3,900	5.50	8,740	6.80	14,230	9.20	26,870
4.30	4,220	5.60	9,140	6.90	14,680	9.40	28,100
4.40	4,550	5.70	9,540	7.00	15,130	9.60	29,340
4.50	4,900	5.80	9,950	7.20	16,030	9.80	30,580
4.60	5,260	5.90	10,360	7.40	16,950	10.00	31,820
4.70	5,630	6.00	10,770	7.60	17,900	10.30	33,720
4.80	6,000	6.10	11,190	7.80	18,890		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 7 discharge measurements made June 27, 1900, August 8, 1901, and in 1904–5. It is well defined between gage heights 3 feet and 7.5 feet. Above gage height 7.5 feet the rating table is based on the extension of the area and velocity curves and is only approximate.

Monthly discharge of New River at Radford, Va., for 1906.

[Drainage area, 2,720 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	33,700	2,160	8,070	2.97	3.42
February	7,160	2,430	3,930	1.44	1.50
March	14,200	3,290	5,230	1.92	2.21
April	11,600	2,430	4,550	1.67	1.86
May	5,260	2,430	3,100	1.14	1.31
June	10,800	2,160	3,970	1.46	1.63
July	2,710	2,160	2,310	.849	.47

NOTE.—Values for 1906 are excellent.

GREENBRIER RIVER AT ALDERSON, W. VA.

The gaging station was established August 1, 1895, and was discontinued July 15, 1906. It is located at the highway bridge one-half mile above the mouth of Muddy Creek, in the village of Alderson, W. Va., 21 miles above Hinton. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 57, where are given also references to publications that contain data for previous years.

The following discharge measurement was made June 13, 1906:

Width, 325 feet; area, 475 square feet; gage height, 2.30 feet; discharge, 602 second-feet.

Daily gage height, in feet, of Greenbrier River at Alderson, W. Va., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.9	3.2	2.3	5.1	2.9	2.6	17	3.8	2.1	5.5	4.9	2.7	2.5
2	2.8	3.0	2.25	4.8	2.8	2.6	18	3.6	2.0	4.22	3.7	2.8	2.55
3	4.45	2.8	2.25	4.2	2.75	2.55	19	3.45	2.0	3.7	3.55	2.8	2.6
4	7.5	2.65	4.15	3.7	3.0	2.55	20	3.3	2.1	4.1	3.4	2.75	2.75
5	6.5	2.55	4.8	3.5	3.35	2.55	21	3.15	2.15	4.2	3.2	2.7	3.5
6	4.8	2.6	3.8	3.5	3.3	2.55	22	3.0	2.25	4.0	3.1	2.7	3.25
7	3.9	2.55	3.3	3.2	3.2	2.55	23	9.3	2.85	4.1	3.05	2.65	3.0
8	3.5	2.45	3.1	4.0	3.2	3.0	24	8.8	2.7	4.05	2.9	2.65	2.75
9	3.3	2.4	3.05	3.8	3.2	3.0	25	5.5	2.6	4.0	2.8	2.6	2.5
10	3.05	2.45	3.0	3.1	3.1	2.6	26	4.5	2.5	4.5	2.75	2.5	2.5
11	2.65	2.4	2.6	4.6	3.0	2.55	27	3.8	2.45	5.1	2.75	2.5	2.3
12	3.0	2.35	2.6	4.1	2.9	2.55	28	3.9	2.4	7.0	3.8	2.5	2.2
13	2.9	2.3	2.55	3.7	2.7	2.5	29	3.9	.....	6.6	3.25	2.55	2.2
14	4.1	2.3	2.6	3.4	2.6	2.5	30	3.6	.....	6.0	3.05	2.55	2.1
15	4.1	2.3	4.9	5.32	2.5	2.5	31	3.4	.....	6.4	.....	2.6	.....
16	3.95	2.3	7.1	5.4	2.6	2.5							

Rating table for Greenbrier River at Alderson, W. Va., for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	340	3.30	2,468	4.60	5,595	6.80	12,425
2.10	431	3.40	2,680	4.70	5,861	7.00	13,140
2.20	537	3.50	2,897	4.80	6,130	7.20	13,860
2.30	659	3.60	3,119	4.90	6,403	7.40	14,600
2.40	798	3.70	3,346	5.00	6,680	7.60	15,350
2.50	954	3.80	3,579	5.20	7,243	7.80	16,120
2.60	1,124	3.90	3,818	5.40	7,818	8.00	16,910
2.70	1,301	4.00	4,062	5.60	8,412	8.20	17,710
2.80	1,483	4.10	4,310	5.80	9,031	8.40	18,510
2.90	1,670	4.20	4,561	6.00	9,675	8.60	19,330
3.00	1,862	4.3	4,815	6.20	10,340	8.80	20,170
3.10	2,059	4.40	5,072	6.40	11,025	9.00	21,030
3.20	2,261	4.50	5,332	6.60	11,725	9.30	22,350

NOTE.—The above table is applicable only for open-channel conditions. It is based on 10 discharge measurements made during 1903–1905 between gage heights 1.4 feet and 8 feet. It is well defined between these limits.

Monthly discharge of Greenbrier River at Alderson, W. Va., for 1906.

[Drainage area, 1,320 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	22,400	1,210	5,110	3.81	4.39
February	2,260	340	928	.693	.72
March	13,500	598	4,770	3.56	4.10
April	7,820	1,390	3,520	2.63	2.93
May	2,570	954	1,490	1.11	1.28
June	2,900	431	1,180	.881	.98

NOTE.—Values for 1906 are probably excellent.

SCIOTO RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Scioto River rises in the eastern part of Auglaize County, Ohio, flows eastward for about 40 miles and then almost due south, entering the Ohio at Portsmouth. Below Columbus, where it is joined by the Olentangy, it is one of the largest and most important streams in the State. The United States Geological Survey maintains stations on both Scioto and Olentangy rivers at Columbus for the purpose of studying the water supply and sewage disposal of that city. The river has considerable fall and flows through a hilly basin, forming numerous good locations for water-power developments.

SCIOTO RIVER NEAR COLUMBUS, OHIO.

This station was originally established for the Ohio State board of health to obtain data for the water-supply and sewage-disposal problems of Columbus. It was located on the Grand View Avenue Bridge, 3 miles northwest of Columbus post-office, and was reestablished on the same bridge for the United States Geological Survey on November 21, 1903. The station was discontinued July 21, 1906. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 60, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Scioto River near Columbus, Ohio, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	10.6	10.41	10.08	16.7	10.4	9.63	9.3
2	10.6	9.96	11.7	15.56	10.3	10.1	9.31
3	10.5	10.06	11.8	14.7	10.15	9.8	9.25
4	12.75	10.06	12.2	13.6	10.06	10.45	9.2
5	13.3	9.99	11.7	12.7	10.05	9.53	9.7
6	12.64	9.9	10.7	11.48	10.02	9.45	9.52
7	12.3	9.89	10.73	11.75	9.99	9.15	12.3
8	11.5	10.02	10.53	11.7	9.9	9.1	10.98
9	11.4	9.9	10.72	11.6	9.91	9.3	10.72
10	10.5	9.8	10.77	11.48	9.8	10.2	10.19
11	10.49	9.72	10.75	11.22	9.7	10.0	10.52
12	10.6	9.73	10.55	11.09	9.7	9.7	9.99
13	10.36	9.73	10.5	10.89	9.69	9.6	9.52
14	10.43	9.98	10.45	10.7	9.7	9.6	9.6
15	9.84	9.89	10.32	12.12	9.7	9.46	9.53
16	12.9	9.78	10.3	11.8	9.72	9.4	9.6
17	13.3	9.82	10.29	11.48	9.7	9.37	9.54
18	12.59	9.9	10.29	10.02	9.6	9.4	9.5
19	12.25	9.82	10.41	10.76	9.59	9.35	9.51
20	11.49	9.9	9.94	10.7	9.55	9.89	9.48
21	11.4	9.54	10.05	10.32	9.5	9.77	9.46
22	11.7	10.09	10.25	10.48	9.48	9.59	.....
23	12.78	10.3	10.09	10.3	9.98	9.6	.....
24	12.57	10.7	10.25	10.4	9.7	9.71	.....
25	11.65	10.0	10.31	10.19	9.5	9.82	.....
26	11.0	10.86	10.61	10.27	9.5	9.8	.....
27	10.9	10.7	21.1	10.51	9.48	9.7	.....
28	10.76	10.3	20.36	11.26	9.7	9.62	.....
29	10.76	.....	17.37	10.9	9.69	9.51	.....
30	10.53	.....	18.5	10.56	9.7	9.37	.....
31	10.5	.....	18.2	.....	9.64	.....	.....

Rating table for Scioto River near Columbus, Ohio, for 1904 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
9.10	43	10.40	475	11.70	1,340	14.00	3,595
9.20	61	10.50	530	11.80	1,420	14.20	3,825
9.30	81	10.60	585	11.90	1,500	14.40	4,065
9.40	103	10.70	645	12.00	1,585	14.60	4,305
9.50	128	10.80	705	12.20	1,755	14.80	4,555
9.60	156	10.90	765	12.40	1,935	15.00	4,805
9.70	186	11.00	830	12.60	2,120	16.00	6,100
9.80	218	11.10	895	12.80	2,310	17.00	7,640
9.90	253	11.20	965	13.00	2,510	18.00	9,200
10.00	291	11.30	1,035	13.20	2,715	19.00	10,850
10.10	332	11.40	1,110	13.40	2,925	20.00	12,600
10.20	376	11.50	1,185	13.60	3,145	21.00	14,450
10.30	424	11.60	1,260	13.80	3,365		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 17 discharge measurements made during 1904–5. It is well defined between gage heights 9 feet and 12 feet. The table above 12 feet is based on 4 measurements from 18 to 23 feet gage height.

Monthly discharge of Scioto River near Columbus, Ohio, for 1906.

[Drainage area, 1,050 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	2,820	232	1,240	1.18	1.36
February	741	139	317	.302	.31
March	14,600	268	2,330	2.22	2.56
April	7,190	372	1,450	1.38	1.54
May	475	123	218	.208	.24
June	502	43	176	.168	.19
July 1-21	1,840	61	302	.288	.22

NOTE.—Values for 1906 are probably excellent. This estimate of accuracy is dependent on continuance of the conditions of flow in 1905, as no measurements have been made in 1906. The value for February may also be slightly in error, due to ice conditions.

OLENTANGY RIVER NEAR COLUMBUS, OHIO.

This station was established October 7, 1903, in connection with the water-supply and sewage-disposal investigations of the city of Columbus, Ohio. It is located 4 miles north of the Columbus post-office and one-fourth mile west of North High street, at the Dodridge Street Bridge. This station was discontinued July 23, 1906. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 64, where are given also references to publications that contain data for previous years.

Gage heights for 1906 are considered very unreliable and hence are not published. The following discharge measurements were made during 1906:

Discharge measurements of Olentangy River near Columbus, Ohio, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 13[a]	Brennan and Kriegsman	135	397	6.77	72
March 4	E. F. Kriegsman	151	832	8.84	1,340
April 7	do	142	658	7.84	598
May 16	do	138	493	6.86	190

[a] River entirely frozen over. Average thickness of ice, 0.6 foot; ice smooth underneath. Gage height is to water surface, which was about 0.05 foot below the ice surface.

LITTLE MIAMI RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Little Miami River rises in the southeastern part of Clark County, flows southwest through Greene and Warren counties, and enters Ohio River just above Cincinnati. The greater part of the drainage area lies to the east, as there is only a narrow piece of country between this and Miami River. The Little Miami is the best power river in the State of Ohio, and the data collected in this basin are of value in that connection and also in connection with sewage and other waste disposal at Springfield.

LITTLE MIAMI RIVER AT LOVELAND, OHIO.

This station was established May 19, 1906, and discontinued July 20, 1906. It is located at the Main Street Bridge in Loveland, Ohio, about 800 feet above the Baltimore and Ohio Railroad bridge in order to furnish data for water-power estimates and for study of methods of disposing of waste products.

The channel is practically straight for 900 feet above and below the station and bends sharply to the right about 900 feet below. Both banks are high and do not overflow. The bed is a rock ledge covered with a thin layer of sand. The velocity is medium. Measurements may be affected by the ruins of an old dam about 1,300 feet below the station.

Discharge measurements are made from the upstream side of the two-span highway bridge to which the gage is attached. The initial point for soundings is the face of the right abutment. A standard chain gage is fastened to the band rail of the bridge; length of chain, 29.00 feet. The gage was read by Stewart Williams. The gage is referred to a standard United States Geological Survey bench mark embedded in the top of the right abutment of the upstream side of the bridge, and stamped "584 Columbus datum," elevation 23.19, above the gage datum.

Discharge measurements of Little Miami River at Loveland, Ohio, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 12	E. F. Kriegsman	291	942	4.30	995
May 21	do	282	672	3.40	344
June 8	do	276	661	3.37	324

Daily gage height, in feet, of Little Miami River at Loveland, Ohio.

Day.	May.	June.	July.	Day.	May.	June.	July.
1		3.32	2.85	17		3.0	4.18
2		3.12	2.9	18		3.28	3.6
3		2.95	2.9	19	3.3	3.2	3.3
4		3.18	3.35	20	3.15	3.12	4.9
5		3.4	3.58	21	3.25	3.05	
6		4.6	3.4	22	3.25	3.12	
7		3.6	3.3	23	3.88	3.0	
8		3.28	4.15	24	3.58	2.9	
9		3.12	3.92	25	3.45	3.32	
10		2.95	3.52	26	3.3	3.05	
11		3.15	3.42	27	3.28	3.18	
12		3.05	3.35	28	4.25	3.08	
13		3.02	3.3	29	3.52	3.15	
14		3.12	3.18	30	3.4	2.98	
15		3.28	2.98	31	3.42		
16		3.22	3.22				

MAD RIVER NEAR SPRINGFIELD, OHIO.

This station was established December 31, 1903, and discontinued March 31, 1906. It is located at the highway bridge 4 miles west of Springfield, Ohio, about 500 feet below the old Red Mill dam. The conditions at this station and the bench marks are decribed in Water-Supply Paper No. 169, page 67, where are given also references to publications that contain data for previous years.

Discharge measurements of Mad River near Springfield, Ohio, in 1904 and 1905.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Feet.*	*Sec.-ft.*
1904.					
January 30	R. W. Pratt	55	224	6.40	334
February 27	do	60	292	6.60	547
March 25	do	99	701	10.20	2,590
April 9	do	63	337	6.90	820
June 25	do	65	239	5.82	262
July 30[a]	do	82	80	5.65	174
August 30[a]	do	97	92	5.56	138
September 23[a]	do	96	95	5.50	127
October 18[a]	do	95	99	5.59	145
November 17[a]	do	96	117	5.64	150
December 28[a]	do	130	939	6.50	407
1905.					
January 12[a]	R. W. Pratt	165	926	6.63	527
February 27[a]	do	125	935	6.97	750
March 23[a]	do	108	830	6.13	326
May 20	M. S. Brennan	117	430	6.64	818
June 18	Sidney K. Clapp	113	350	6.00	341
July 11	do	111	330	5.92	279
August 24[a]	R. W. Pratt	103	699	5.86	234
August 24	do	111	321	5.87	259
October 11[a]	do	105	744	6.18	351
November 11[a]	do	105	702	6.15	300
1906.					
March 3	E. F. Kriegsman	115	524	7.42	1,420

[a] Made at different sections.

Daily gage height, in feet, of Mad River near Springfield, Ohio, for 1906.

Day.	March.	Day.	March.
1	6.0	17	6.1
2	5.9	18	6.0
3	7.7	19	6.0
4	6.7	20	6.0
5	6.5	21	6.1
6	6.3	22	6.1
7	6.2	23	6.2
8	6.3	24	6.1
9	6.3	25	6.2
10	6.3	26	7.0
11	6.3	27	15.0
12	6.3	28	11.3
13	6.2	29	9.6
14	6.2	30	11.0
15	6.2	31	10.5
16	6.1		

Rating table for Mad River near Springfield, Ohio, applicable February 7 to March 27 and July 14 to October 31, 1904; January 13 to February 3, February 22 to May 12, and July 1 to October 16, 1905.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.20	35	6.10	345	7.00	740	8.80	1,710
5.30	60	6.20	385	7.20	840	9.00	1,830
5.40	90	6.30	425	7.40	940	10.00	2,440
5.50	123	6.40	465	7.60	1,040	11.00	3,090
5.60	157	6.50	505	7.80	1,145	12.00	3,790
5.70	192	6.60	550	8.00	1,255	13.00	4,515
5.80	228	6.70	595	8.20	1,365	14.00	5,265
5.90	266	6.80	640	8.40	1,475	15.00	6,015
6.00	305	6.90	690	8.60	1,590		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904 and 1905. It is based on an average curve, and is applied directly over the periods indicated above. During periods when discharge measurements do not plot fairly close to the curve it has been used as a basis for determining the daily discharge by the indirect method for shifting conditions of flow. Below gage height 5.4 feet the curve is only approximate.

Monthly discharge of Mad River near Springfield, Ohio, for 1904 to 1906.

[Drainage area, 290 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1904.					
January	5,000	120	629	2.17	2.50
February	3,020	300	790	2.72	2.93
March	6,320	505	1,320	4.55	5.25
April	5,200	450	959	3.31	3.69
May	520	310	385	1.33	1.53
June	770	220	299	1.03	1.15
July	920	123	314	1.08	1.24
August	228	90	143	.493	.57
September	192	30	129	.445	.50
October	247	123	159	.548	.63
November	172	115	142	.490	.55
December	1,070	95	179	.617	.71
The year	6,320	30	454	1.57	21.25
1905.					
January	505	90	233	.803	.93
February	1,360	150	324	1.12	1.17
March	1,590	266	522	1.80	2.08
April	1,140	210	430	1.48	1.65
May	3,400	266	839	2.89	3.33
June	3,600	270	689	2.37	2.64
July	465	192	274	.945	1.09
August	690	157	301	1.04	1.20
September 1-23	2,000	192	531	1.83	1.57
October 1-16	940	266	431	1.49	.89
November 11-30	300	210	252	.869	.65
December 1-16	660	170	308	1.06	.63
1906.					
March	6,500	620	1,320	4.55	5.25

NOTE.- Ice conditions January 3 to 12, 1904, and February 4 to 21, 1905. Daily discharge estimated during ice period. Values are rated as follows: January, 1904, fair; February and March, 1904, excellent; April and May, 1904, good; June to October, 1904, excellent; November, 1904, good; December, 1904, fair; January, 1905, fair; February, 1905, approximate; March, 1905, excellent; April, 1905, fair; May, 1905, approximate; June, 1905, fair; July to October, 1905, excellent; November and December, 1905, fair; March, 1906, approximate.

MIAMI RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The Miami furnishes the main drainage system of southwestern Ohio. Exclusive of the Whitewater, it has a drainage area of nearly 4,000 square miles, or about one-tenth of the State of Ohio. Its headwaters are at the continental watershed, and it drains the greater part of the Cincinnati arch from that watershed south to Ohio River. One of the eastern tributaries, Mad River, heads in the elevated tract near Bellefontaine, at an elevation of fully 1,200 feet above tide. The other headwaters, except the Whitewater, have their sources at an elevation of about 1,000 feet. The Whitewater, as noted above, rises in the higher part of eastern Indiana, at an elevation of nearly 1,200 feet.

The valleys of the headwaters as far down as the vicinity of Dayton are narrow and comparatively shallow post-Glacial channels with courses independent of pre-Glacial drainage lines. Mad River, it is true, occupies a broad trough-like valley, but on its borders are moraines which cause most of the relief, the bluffs being generally

but 20 or 30 feet high. Below Dayton the Miami and some of its tributaries occupy pre-Glacial lines which are only partly filled with glacial deposits. The work of the present streams has been in the main a reexcavation of the valleys. In this work they have fallen far short of reaching the old rock floors that lie 100 to 200 feet below their beds. The depth of this reexcavation is but 50 to 100 feet, and the width is but a small fraction of that of the old valley, seldom so much as one-fourth as great. The contrast between the southern and the northern portion of this drainage basin, therefore, is not found in the work of the present streams, but is due to the less complete concealment of pre-Glacial drainage lines.

The fall of the Miami is rapid throughout its entire length, being seldom less than 3 feet and usually over 4 feet per mile. The streams in this drainage system seldom reach a very low stage in seasons of drought, for the valleys are usually filled with gravelly or sandy deposits which furnish strong springs. Even in the small tributaries water-bearing beds outcrop along the banks or bluffs.

This stream and several of its tributaries afford valuable water power, the utilization of which is discussed by Prof. Dwight Porter in the Tenth Census Report.[a] From this report it appears that a total of 9,431 horsepower was used in 1880 by 290 mills, manufactories, etc., on the Miami and its tributaries, including Whitewater River.

The following pages contain the results of stream measurement data collected by the United States Geological Survey in the drainage basin of Miami River:

MIAMI RIVER AT DAYTON, OHIO.

This station was established March 18, 1905. It is located at the Miami Street Bridge, Dayton, Ohio, about one-half mile below the mouth of Mad River. There is a dam 1 mile above the station which may divert water through a canal and discharge it 1,000 feet below the gaging section. There is also a dam on Mad River, 2½ miles above the station, where water is diverted into the Miami canal. Besides water power the data at this station are valuable for water supply and sewage disposal. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 69. The gage heights are furnished by the United States Weather Bureau.

[a] Tenth Census of United States, 1880, Vol. XVII, pp. 478-487.

Discharge measurements of Miami River at Dayton, Ohio, in 1905 and 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 18	R. W. Pratt	406	1,600	2.15	1,530
May 19	M. S. Brennan	443	1,880	3.53	4,450
June 17	Sidney K. Clapp	373	1,090	1.60	967
July 11	do	359	897	1.10	615
August 25	R. W. Pratt	382	1,630	2.45	1,710
October 12	do	377	1,260	1.55	713
November 18	do	385	1,200	1.48	665
1906.					
March 3	E. F. Kriegsman	377	1,540	2.35	1,790
April 6	do	348	1,890	3.70	4,630
April 11	do	382	1,550	3.07	3,290
June 4	Murphy and Kriegsman	219	1,600	1.25	670

Daily gage height, in feet, of Miami River at Dayton, Ohio, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.3	2.2	1.5	7.8	1.8	1.2	1.0	1.4	1.1
2	2.1	2.2	1.5	6.8	1.7	1.2	1.0	1.3	1.0
3	3.3	2.2	2.2	5.5	1.7	1.2	1.3	1.1	1.0
4	5.2	2.3	2.5	8.5	1.6	1.1	1.1	1.0	1.0
5	5.1	2.5	2.4	3.7	1.6	1.1	1.0	1.0	0.9
6	3.9	.....	2.3	3.7	1.6	1.2	0.9	0.9	.7
7	3.0	.....	1.5	3.5	1.5	1.2	1.0	.7	.9
8	2.8	.....	1.9	3.2	1.5	1.0	3.0	1.0	.8
9	3.0	.....	1.9	3.0	1.5	1.0	2.0	3.0	.7
10	3.0	.....	2.0	3.4	1.5	1.0	2.0	2.9	.7
11	3.0	.....	2.0	3.2	1.4	1.0	2.2	2.2	.7
12	3.0	.....	1.9	2.9	1.4	0.9	1.5	1.6	.7
13	3.3	.....	1.9	2.7	1.3	.9	1.2	1.2	.7
14	2.8	.....	1.9	2.5	1.3	.9	1.1	1.3	.6
15	2.4	1.8	1.8	2.5	1.2	1.0	1.5	1.2	.6
16	5.3	2.0	1.8	2.5	1.2	1.0	1.6	1.1	.6
17	5.0	1.9	1.8	2.5	1.1	1.0	1.7	1.0	.6
18	3.7	1.8	1.8	2.4	1.1	1.1	1.8	1.5	.7
19	3.2	1.8	1.7	2.3	1.1	1.1	1.9	1.3	.7
20	3.0	1.9	1.6	2.2	1.2	1.0	2.0	1.6	.7
21	2.9	1.9	1.7	2.1	1.2	1.0	2.4	2.0	.7
22	3.0	2.0	1.8	2.0	1.1	1.0	1.0	2.0	.7
23	4.0	2.0	1.7	2.0	1.4	1.0	1.0	2.0	.8
24	3.5	2.0	1.8	2.0	1.3	0.9	1.2	1.9	.7
25	3.0	1.9	1.8	1.9	1.1	.9	1.1	1.8	.7
26	2.7	1.8	1.7	1.9	1.0	.8	1.0	1.4	.7
27	2.5	1.8	10.0	1.9	1.2	.8	1.0	2.0	.7
28	2.3	1.8	11.9	1.8	1.3	.8	1.2	2.4	.7
29	2.3	.....	8.0	1.8	1.3	.7	2.5	2.0	.8
30	2.3	.....	7.4	1.7	1.3	.7	2.0	1.7	.8
31	2.3	.....	8.7	.....	1.3	.....	1.4	1.5	.....

NOTE.—River frozen February 5 to 14.

Rating table for Miami River at Dayton, Ohio, for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.50	220	1.80	1,160	3.10	3,250	4.80	8,300
0.60	260	1.90	1,260	3.20	3,490	5.00	9,000
0.70	310	2.00	1,370	3.30	3,740	5.20	9,720
0.80	360	2.10	1,490	3.40	4,000	5.40	10,450
0.90	420	2.20	1,620	3.50	4,270	5.60	11,190
1.00	480	2.30	1,750	3.60	4,540	5.80	11,940
1.10	550	2.40	1,890	3.70	4,820	6.00	12,700
1.20	620	2.50	2,040	3.80	5,110	7.00	16,700
1.30	700	2.60	2,210	3.90	5,400	8.00	20,900
1.40	780	2.70	2,390	4.00	5,700	9.00	25,200
1.50	870	2.80	2,590	4.20	6,320	10.00	29,600
1.60	960	2.90	2,800	4.40	6,960	11.00	34,100
1.70	1,060	3.00	3,020	4.60	7,620		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 7 discharge measurements made during 1905 and 1906. It is well defined between gage heights 1.0 feet and 4.0 feet. The extension above 7.0 feet is approximate.

Monthly discharge of Miami River at Dayton, Ohio, for 1905 and 1906.

[Drainage area, 2,450 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile	Depth in inches.
1905.					
April 16-30	7,960	620	2,430	.992	.55
May	26,500	620	4,720	1.93	2.22
June	5,400	620	1,550	.633	.71
July	1,060	310	519	.212	.24
August	5,700	220	1,300	.531	.61
September	9,360	420	2,860	1.17	1.30
1906.					
January	10,100	1,490	3,810	1.56	1.80
February	1,750	1,000	1,240	.506	.53
March	38,200	870	5,270	2.15	2.48
April	23,000	1,060	4,300	1.76	1.96
May	1,160	480	749	.306	.35
June	620	310	479	.196	.22
July	3,020	420	951	.388	.45
August	3,020	310	1,030	.420	.48
September	550	260	342	.140	.16

NOTE.—Daily discharge during frozen period estimated. Values are rated as follows: 1905, excellent, except July, which is good; January, April, May, July, and August, 1906, excellent; February, March, June, and September, 1906, good.

KENTUCKY RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Kentucky River drains into the Ohio from the south about halfway between Cincinnati, Ohio, and Louisville, Ky. The data collected in this basin are valuable for water-power purposes.

KENTUCKY RIVER AT FRANKFORT, KY.

This station was established March 18, 1905, and discontinued July 21, 1906. It is located at the Government dam on the Kentucky River in the lower part of Frankfort, Ky., about 1 mile below the city highway bridge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 70.

The following discharge measurement was made April 16, 1906:

Width, 374 feet; area, 3,890 square feet; gage height, 8.12 feet; discharge, 10,800 second-feet.

Daily gage height, in feet, of Kentucky River at Frankfort, Ky., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	7.0	7.3	7.4	17.5	6.4	7.0	6.2
2	6.9	7.45	7.8	14.5	6.3	7.0	6.1
3	7.0	7.5	9.8	12.7	6.4	7.1	6.0
4	8.3	7.55	10.8	10.0	6.6	6.6	5.9
5	8.8	7.3	10.3	8.9	6.8	6.4	5.8
6	8.1	7.0	10.2	8.3	6.8	6.1	5.8
7	7.7	6.85	9.3	8.0	6.8	6.1	6.1
8	7.5	6.8	8.5	8.0	7.8	6.0	5.9
9	7.3	6.6	8.1	7.9	7.7	5.9	5.8
10	7.1	6.45	7.8	7.8	7.5	5.9	5.8
11	7.0	6.4	7.6	7.8	7.5	5.9	5.9
12	7.2	6.4	7.4	8.0	7.2	5.9	6.2
13	7.7	6.4	7.3	8.0	6.9	5.8	6.2
14	9.2	6.4	7.9	7.9	6.8	6.5	6.0
15	10.2	6.4	8.3	7.5	6.6	6.4	6.0
16	10.3	6.4	10.2	7.8	6.4	6.4	5.9
17	9.9	6.4	10.4	8.5	6.4	6.3	6.5
18	9.2	6.35	9.6	8.4	6.2	6.3	6.7
19	8.6	6.35	9.0	7.9	6.1	6.4	6.5
20	8.0	6.3	9.6	7.5	6.1	6.3	6.2
21	7.8	6.3	9.3	7.3	6.1	6.2	6.5
22	7.5	6.5	8.8	7.1	6.0	6.1	.....
23	8.0	6.9	8.4	6.95	5.9	5.9	.....
24	8.05	7.3	8.0	6.85	5.9	6.2	.....
25	7.6	8.0	8.0	6.8	5.85	6.1	.....
26	7.3	7.7	8.4	6.7	6.0	6.0	.....
27	7.1	7.5	9.4	6.5	5.9	6.0	.....
28	7.0	7.3	9.3	6.4	5.85	6.1	.....
29	6.9	.....	9.3	6.4	7.0	6.2	.....
30	6.8	.....	14.3	6.4	6.7	6.2	.....
31	6.9	.....	21.1	.....	6.4	.....	.....

SALT RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Salt River drains into the Ohio from the south about 20 to 30 miles below Louisville, Ky. The data collected in this basin are valuable for water-power purposes.

ROLLING FORK OF SALT RIVER AT NEW HAVEN, KY.

This station was established June 16, 1905, and discontinued March 31, 1906. It is located on the only two-span steel railroad bridge in New Haven, Ky., about one-fourth mile from the business section of the city. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 72.

Daily gage height, in feet, of Rolling Fork of Salt River at New Haven, Ky., for 1906.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	.....	1.9	7.2	17	4.5	1.4	5.7
2	.....	1.7	7.7	18	3.5	1.3	4.0
3	5.8	1.6	13.2	19	3.0	1.4	5.9
4	7.2	1.6	16.0	20	2.7	1.2	7.2
5	5.7	1.7	7.5	21	.....	1.3	6.8
6	3.7	1.5	4.7	22	11.1	1.7	4.5
7	2.7	1.1	3.9	23	13.6	2.8	3.7
8	2.5	1.1	3.5	24	8.3	2.5	4.2
9	2.4	1.4	3.4	25	5.3	.....	5.7
10	2.0	1.2	3.6	26	3.7	2.4	5.3
11	2.1	1.3	3.3	27	3.2	3.7	8.7
12	2.4	1.3	2.9	28	.....	7.3	9.0
13	3.6	1.4	2.9	29	2.4	.....	10.3
14	.....	1.6	3.5	30	2.1	.....	17.1
15	7.0	1.6	5.3	31	2.1	.....	18.2
16	4.7	1.5	8.1				

WABASH RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The drainage basin of the Wabash embraces an area of about 33,000 square miles, distributed as follows: In Ohio, 400 square miles; in Indiana, 24,350 square miles; in Illinois, 8,250 square miles. It drains, therefore, slightly more than two-thirds of Indiana, the area of the State being 35,910 square miles. Of the portion in Indiana, about one-half is embraced in the drainage areas of East and West White rivers. By including these drainage areas with the Wabash, the entire basin has nearly symmetrical, broadly ovate form. Not including the White River system, the Wabash basin is an unsymmetrical, elongated tract, curving around White River.

The length of the valley occupied by the Wabash is about 450 miles, but the length of the stream is fully 500 miles, for the river in its lower course makes several oxbow curves within the valley. The source of the river is about 1,000 feet above tide, while its mouth at low water is but 311 feet. The average fall, if we estimate the stream to have a length of 500 miles, is therefore about 16.5 inches per mile. The rate of descent is far from uniform, being much more rapid in the upper portion than in the lower. There are also many rapids, separated by pools or sluggish portions of the stream. The elevation of the stream is accurately determined at many points, but in the absence of a careful measurement of the length of the stream the rate of fall is only approximately known. The section above the point where the river enters the old lake outlet, estimated to have a length of 100 miles, has a fall of about 300 feet, or 3 feet per mile. Railway levels and canal surveys, at the point where the river joins the old lake outlet, show its elevation to be nearly 700 feet above sea level, the altitudes reported varying between 696 and 699 feet.

The following table gives the elevation and fall at various points:

Table of altitudes and distances along Wabash River.

Location.	Estimated distance.	Altitude.	Fall per mile.
	Miles.	*Feet.*	*Inches.*
Source	0.0	1,000.0	0.0
Huntington	100.0	699.0	36.0
Mouth of Salamonie River	15.0	667.0	25.6
Mouth of Mississinewa River	20.0	633.0	20.4
Logansport	20.0	583.0	30.0
Lafayette	50.0	506.0	18.5
Attica	25.0	487.0	9.1
Covington	20.0	470.0	10.2
Terre Haute	55.0	447.7	4.9
State Line	14.6	440.6	5.8
Hutsonville, Ill	29.0	424.6	6.6
Vincennes	46.4	398.8	6.7
Mouth of White River	32.5	376.5	8.2
Grayville, Ill	28.0	365.0	4.9
Mouth of Little Wabash River	46.0	323.0	11.0
Mouth of Wabash River	16.0	311.0	9.0

WABASH RIVER AT LOGANSPORT, IND.

This station was established April 27, 1903, and was discontinued July 21, 1906. It is located at the Cicott Street Bridge, about 1 mile from the center of the city of Logansport, Ind., 1¾ miles from the Wabash Railroad station, 1½ miles from the Pennsylvania station, four blocks from the street-car line, and 1,000 feet below the mouth of Eel River. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 74, where are given also references to publications that contain data for previous years. The data collected at this station are valuable for water-power purposes.

Discharge measurements of Wabash River at Logansport, Ind., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 9 [a]	Brennan and Kriegsman	486	991	2.02	1,270
March 10	E. F. Kriegsman	499	1,390	2.78	3,010
April 3	do	529	2,880	5.42	11,800
May 10	do	481	903	1.72	1,070

[a] Ice along the edges of the river.

Daily gage height, in feet, of Wabash River at Logansport, Ind., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	2.73	2.58	2.08	7.9	1.9	1.72	1.52
2	2.57	1.4	1.88	6.85	2.4	1.66	1.55
3	2.48	1.18	2.48	5.6	1.9	1.66	1.6
4	2.38	1.58	3.83	4.85	1.9	1.7	1.6
5	4.88	1.88	3.3	3.9	1.8	1.7	1.75
6	4.43	2.03	2.93	3.8	1.8	1.72	1.87
7	3.88	2.03	2.78	3.6	1.76	1.7	1.75
8	3.2	2.06	2.7	4.4	1.72	1.5	1.75
9	2.63	1.97	.....	6.7	1.76	2.7	1.69
10	2.0	1.88	2.78	7.15	1.73	2.4	1.6
11	2.18	1.83	2.68	5.9	1.66	2.06	1.86
12	2.38	1.78	2.58	4.85	1.65	1.8	1.8
13	2.18	1.83	2.53	4.8	1.6	1.86	1.83
14	2.15	1.88	2.41	4.7	1.72	1.8	1.82
15	2.08	2.08	2.28	5.9	1.72	1.76	1.8
16	2.68	2.18	2.23	5.25	1.8	1.72	1.8
17	2.88	2.23	2.18	3.8	1.68	1.7	1.8
18	3.18	1.88	2.08	3.4	1.6	1.72	1.8
19	3.08	1.73	1.93	3.3	1.6	1.66	1.8
20	2.88	1.78	1.98	2.86	1.4	1.6	1.8
21	3.88	1.78	1.98	.....	1.43	1.6	1.8
22	8.21	1.83	2.03	2.6	1.53	1.72	1.8
23	6.88	1.78	2.08	2.4	1.52	1.36	1.78
24	5.88	1.88	1.88	2.3	1.56	.....	.....
25	4.88	2.08	1.88	2.2	1.76	1.19	.....
26	4.13	2.38	1.98	2.2	1.5	1.19	.....
27	3.88	2.71	8.48	2.2	1.5	1.3	.....
28	3.68	2.58	9.03	2.1	1.6	1.37	.....
29	3.03	.....	8.38	2.15	1.44	1.4	.....
30	2.88	.....	8.18	2.1	1.47	1.57	.....
31	.....	.....	8.03	.....	1.84	.....	.....

NOTE.—Flow was not greatly affected by ice conditions.

Rating table for Wabash River at Logansport, Ind., for 1906.

Gage height	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	310	2.30	1,900	3.40	4,690	5.00	9,770
1.30	400	2.40	2,110	3.50	4,980	5.20	10,480
1.40	500	2.50	2,330	3.60	5,270	5.40	11,210
1.50	610	2.60	2,560	3.70	5,570	5.60	11,950
1.60	730	2.70	2,800	3.80	5,870	5.80	12,710
1.70	860	2.80	3,050	3.90	6,170	6.00	13,500
1.80	1,000	2.90	3,310	4.00	6,480	7.00	17,600
1.90	1,160	3.00	3,580	4.20	7,110	8.00	22,100
2.00	1,330	3.10	3,850	4.40	7,750	9.00	26,800
2.10	1,510	3.20	4,130	4.60	8,410	9.10	27,280
2.20	1,700	3.30	4,410	4.80	9,080		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903 to 1906. It is well defined.

Monthly discharge of Wabash River at Logansport, Ind., for 1906.

[Drainage area, 3,160 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile	Depth in inches.
January	23,000	1,330	5,280	1.67	1.92
February	2,820	294	1,320	.418	.44
March	26,900	1,130	5,720	1.81	2.09
April	21,600	1,510	7,360	2.33	2.60
May	2,110	500	863	.273	.31
June	2,800	302	876	.277	.31
July 1-23	1,110	634	930	.294	.25

NOTE.—Values for 1906 are excellent.

WABASH RIVER AT TERRE HAUTE, IND.

This station was established February 25, 1905, and was discontinued July 20, 1906. It is located at the Vandalia Line railway bridge, near the city waterworks. There are no tributaries nor any islands, falls, or dams in the river near the station. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 77, where are given also references to publications that contain data for previous years. The data collected at this station are valuable in connection with water-power, water-supply, and sewage-disposal problems.

Discharge measurements of Wabash River at Terre Haute, Ind., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 16 [a]	Brennan and Kriegsman	482	3,790	4.40	6,710
March 28	E. F. Kriegsman	606	10,700	15.84	40,600
March 31	do	714	13,000	19.20	62,800
April 18	do	580	8,520	12.02	25,500
April 19	do	564	7,740	10.80	22,200
April 20	do	557	6,790	9.30	19,300
April 20	do	557	6,650	8.92	18,200
April 21	do	552	6,2.0	7.95	16,800
April 21	do	549	5,950	7.65	16,200
April 23	do	541	5,190	6.35	13,200
June 9	do	535	4,500	4.98	11,400

[a] Partial ice conditions.

Daily gage height, in feet, of Wabash River at Terre Haute, Ind., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	4.68	8.22	5.02	19.8	3.88	5.72	1.08
2	4.72	7.28	4.88	19.22	3.8	4.22	1.22
3	4.85	6.0	7.38	18.45	3.78	3.5	1.35
4	5.88	5.58	9.9	17.7	3.75	2.88	1.32
5	6.5	5.15	10.78	16.8	3.78	2.88	1.38
6	7.35	4.55	10.48	15.22	3.52	3.2	1.7
7	7.85	2.45	9.28	12.9	3.3	3.12	1.72
8	7.18	2.35	8.48	10.75	3.1	2.52	1.62
9	5.82	2.7	8.3	14.22	2.95	4.22	1.6
10	4.78	2.78	8.18	15.02	2.9	5.55	1.52
11	3.85	2.92	7.82	15.1	2.82	4.52	1.42
12	4.02	3.02	7.28	15.3	2.72	4.08	1.35
13	3.62	3.2	6.75	15.42	2.62	3.38	1.32
14	3.58	3.72	6.38	14.95	2.52	2.92	1.32
15	3.55	4.42	5.98	12.85	2.45	2.6	1.25
16	3.75	4.15	5.58	12.52	2.35	2.32	1.22
17	3.82	3.4	5.28	12.75	2.28	2.12	1.4
18	3.88	3.12	4.98	12.25	2.15	1.98	1.75
19	3.95	3.6	4.82	10.7	2.12	1.82	1.7
20	4.65	4.02	4.55	9.1	2.08	1.75	1.42
21	5.72	4.2	4.35	7.9	2.02	1.75	.....
22	13.68	3.78	4.42	6.95	1.92	1.7	.....
23	15.95	3.82	4.6	6.28	1.9	1.68	.....
24	16.82	3.78	4.52	5.72	1.85	1.6	.....
25	17.12	4.18	4.48	5.38	1.9	1.5	.....
26	17.38	5.0	6.35	5.05	1.98	1.42	.....
27	17.22	5.22	14.28	4.78	1.9	1.3	.....
28	16.25	5.3	15.88	4.48	2.12	1.28	.....
29	14.12	.....	16.42	4.25	2.08	1.2	.....
30	11.18	.....	17.02	4.05	1.88	1.15	.....
31	9.3	.....	18.95	.....	4.32	.....	.....

NOTE.—Ice gorge at railroad bridge, a short distance above the gaging section, February 7 to 18. The flow at the gaging section was probably affected by ice on only February 15 and 16.

Rating table for Wabash River at Terre Haute, Ind., for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	2,050	2.50	4,510	4.00	7,620	7.00	14,700
1.10	2,180	2.60	4,700	4.20	8,060	8.00	17,200
1.20	2,320	2.70	4,900	4.40	8,500	9.00	19,800
1.30	2,460	2.80	5,100	4.60	8,940	10.00	22,500
1.40	2,610	2.90	5,300	4.80	9,380	11.00	25,300
1.50	2,770	3.00	5,500	5.00	9,830	12.00	28,400
1.60	2,940	3.10	5,700	5.20	10,300	13.00	31,800
1.70	3,110	3.20	5,900	5.40	10,780	14.00	35,500
1.80	3,280	3.30	6,100	5.60	11,260	15.00	39,500
1.90	3,450	3.40	6,310	5.80	11,740	16.00	43,700
2.00	3,620	3.50	6,520	6.00	12,220	17.00	48,100
2.10	3,790	3.60	6,740	6.20	12,700	18.00	52,700
2.20	3,970	3.70	6,960	6.40	13,200	19.00	57,400
2.30	4,150	3.80	7,180	6.60	13,700	20.00	62,100
2.40	4,330	3.90	7,400	6.80	14,200		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905 and 1906. It is well defined.

Monthly discharge of Wabash River at Terre Haute, Ind., for 1905 and 1906.

[Drainage area, 12,200 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
March	39,500	7,620	16,400	1.34	1.54
April	25,000	3,650	10,700	.877	.98
May	48,100	7,400	19,400	1.59	1.83
June	15,400	4,330	9,240	.757	.84
July	9,270	2,640	5,250	.430	.50
August	5,100	2,250	3,420	.280	.32
September	10,100	2,610	4,980	.408	.46
October	9,650	1,920	3,950	.324	.37
November	17,200	2,640	4,840	.397	.44
December	22,100	4,470	9,880	.810	.93
1906.					
January	49,800	6,630	19,600	1.61	1.86
February	17,800	4,240	8,050	.660	.69
March	57,200	8,390	19,000	1.56	1.80
April	61,200	7,730	29,500	2.42	2.70
May	8,320	3,360	4,910	.402	.46
June	11,500	2,250	5,010	.411	.46
July 1-20	3,200	2,150	2,680	.220	.16

NOTE.—The 1905 monthly discharge has been recomputed on the basis of the above rating table, which gives better results for medium and high stages.

Values for February 15 and 16, 1906, reduced on account of ice conditions on those days. Discharge during the remainder of the winter period considered unaffected by ice conditions. Values for 1905 and 1906 are excellent.

The following table gives the horsepower (80 per cent efficiency) per foot of fall that may be developed at different rates of discharge and shows the number of days on which the flow and the corresponding horsepower were respectively less than the amounts given in the columns for "discharge" and "horsepower."

Discharge and horsepower table for Wabash, Terre Haute, Ind., for 1905 and 1906.

Discharge in second-feet.	Horsepower; 80 per cent efficiency per foot fall.	Number of days of deficient flow.	
		1905. [a]	1906. [b]
1,980	180	1	.....
2,200	200	6	1
2,750	250	28	18
3,300	300	57	31
3,850	350	82	45
4,400	400	101	51
4,950	450	124	59

[a] March to December.
[b] January to July 20.

NOTE.—The minimum flow during the period covered by the above table was 1,920 second-feet, giving 175 horsepower per foot of fall on one day in October, 1905.

TIPPECANOE RIVER NEAR DELPHI, IND.

This station was established March 14, 1903, and was discontinued July 20, 1906. It is located at the highway bridge at Springboro, Ind. The nearest railroad station is Delphi, 5 miles east of Springboro. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 80, where are given also references to publications that contain data for previous years. The data collected at this station are valuable for water-power purposes.

Discharge measurements of Tippecanoe River at Delphi, Ind., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 10 [a]	Brennan and Kriegsman	272	522	3.86	1,450
March 10	E. F. Kriegsman	335	790	4.74	3,320
April 3	do	325	779	4.62	3,090
May 9	do	257	361	3.27	962

[a] Slush and cake ice running.

Daily gage height, in feet, of Tippecanoe River near Delphi, Ind., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	3.75	5.17	4.18	5.47	3.49	3.1	3.0
2	3.73	4.8	4.76	5.25	3.45	3.04	3.02
3	3.7	4.2	5.34	4.97	3.57	3.0	3.0
4	3.72	4.16	5.27	4.63	3.51	2.99	2.99
5	3.78	4.09	5.21	4.37	3.44	2.97	2.97
6	3.74	4.02	4.99	4.6	3.43	3.04	2.96
7	3.69	3.96	4.96	4.5	3.4	3.0	2.94
8	3.66	3.93	4.89	4.42	3.33	2.95	2.9
9	3.61	3.9	4.83	5.7	3.27	3.1	2.88
10	3.58	3.87	4.82	5.27	3.25	3.08	2.85
11	3.55	3.84	4.79	5.06	3.21	3.11	2.84
12	3.52	3.81	4.76	4.89	3.19	3.32	2.87
13	3.47	3.78	4.72	4.56	3.22	3.26	2.9
14	3.43	3.76	4.68	4.63	3.18	3.17	2.81
15	3.57	3.68	4.66	5.17	3.16	3.13	2.85
16	3.51	3.64	4.59	4.95	3.15	3.1	2.98
17	3.48	3.61	4.37	4.8	3.14	3.04	2.97
18	3.46	3.66	4.19	4.67	3.11	3.0	2.9
19	3.42	3.64	3.94	4.43	3.09	2.99	2.84
20	4.73	3.6	3.88	4.37	3.08	3.0	2.82
21	5.8	3.57	3.75	4.19	3.05	2.95	.....
22	6.12	3.52	3.73	4.0	3.03	2.96	.....
23	6.36	3.48	3.7	3.96	3.1	2.94	.....
24	6.39	3.45	3.75	3.91	3.15	2.93	.....
25	6.3	4.4	3.78	3.84	3.13	2.93	.....
26	6.15	4.33	4.12	3.76	3.11	2.9	.....
27	6.1	4.28	6.18	3.65	3.07	2.87	.....
28	6.0	4.21	6.0	3.6	3.05	2.85	.....
29	5.85	.....	5.94	3.57	3.03	2.95	.....
30	5.57	.....	5.86	3.53	3.1	3.02	.....
31	5.25	.....	5.71	.....	3.15	.....	.....

NOTE.—Flow slightly affected by ice conditions February 5 to 10.

Rating table for Tippecanoe River near Delphi, Ind., for 1904 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.80	390	3.70	1,620	4.60	3,090	5.50	4,860
2.90	510	3.80	1,770	4.70	3,270	5.60	5,070
3.00	630	3.90	1,930	4.80	3,450	5.70	5,280
3.10	760	4.00	2,090	4.90	3,640	5.80	5,490
3.20	890	4.10	2,250	5.00	3,830	5.90	5,700
3.30	1,030	4.20	2,410	5.10	4,030	6.00	5,910
3.40	1,170	4.30	2,580	5.20	4,230	6.20	6,350
3.50	1,320	4.40	2,750	5.30	4,440	6.40	6,790
3.60	1,470	4.50	2,920	5.40	4,650		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 28 discharge measurements made during 1903 to 1906. It is well defined.

Monthly discharge of Tippecanoe River near Delphi, Ind., for 1906.

[Drainage area, 1,890 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	6,770	1,200	3,100	1.64	1.89
February	4,170	1,240	1,930	1.02	1.06
March	6,310	1,620	3,400	1.80	2.08
April	5,280	1,360	2,960	1.57	1.75
May	1,420	670	916	.485	.56
June	1,060	450	663	.351	.39
July 1-20	660	400	528	.279	.21

NOTE.—Correction made in daily discharge values for February 5 to 10 on account of ice conditions. Values for 1906 are excellent.

The following table gives the horsepower (80 per cent efficiency) per foot of all that may be developed at different rates of discharge, and shows the number of days on which the flow and the corresponding horsepower were, respectively, less than the amounts given in the columns for "discharge" and "horsepower."

Discharge and horsepower table for Tippecanoe River near Delphi, Ind., for 1903 to 1906.

Discharge in second-feet.	Horsepower, 80 per cent efficiency, per foot fall.	Number of days of deficient flow.			
		1903.	1904.	1905.	1906.[a]
275	25	.....	1	.....	.....
330	30	.....	9	.....	.....
385	35	.....	12	.....	.....
440	40	.....	43	59	2
495	45	.....	67	59	10
550	50	.....	105	63	14
660	60	22	156	84	36
770	70	66	172	111	54
880	80	117	183	125	66
990	90	136	191	146	71
1,100	100	158	200	160	74
1,320	120	197	210	185	86

[a] January 1–July 20.

NOTE.—The minimum flow during the period covered by the above table was 269 second-feet, giving 24 horsepower per foot of fall, on one day in August, 1904.

WEST BRANCH OF WHITE RIVER AT INDIANAPOLIS, IND.

This station was established May 6, 1904, and was discontinued July 21, 1906. It is located in the central portion of the city, on the bridge of the Cleveland, Cincinnati, Chicago and St. Louis Railway. The waterworks canal, which draws water from the river about 7 miles above the gaging station for the city supply and for power purposes, very seriously modifies the low-water flow of the river, as it takes at least 25 per cent of the low-water flow. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 83, where are given also references to publications that contain data for previous years. The data collected at this station are valuable for water-power, water-supply, and sewage-disposal purposes.

Discharge measurements of West Branch White River at Indianapolis, Ind., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 14	Brennan and Kriegsman	227	1,160	7.80	765
February 28	E. F. Kriegsman	221	1,200	8.00	1,000
March 30	do	331	3,050	13.64	10,500
March 31	do	331	3,700	16.00	18,000
June 9	do	226	1,110	7.78	645

Daily gage height, in feet, of West Branch White River at Indianapolis, Ind., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	8.45	8.5	7.95	16.45	7.85	8.75	7.1
2	8.25	8.3	8.3	14.55	7.8	8.6	7.1
3	8.5	7.9	8.8	12.4	7.8	8.4	7.1
4	10.6	7.85	9.3	11.15	7.75	7.9	7.4
5	11.85	7.7	9.45	10.7	7.8	8.2	7.15
6	10.85	7.55	9.0	10.35	7.7	8.0	7.25
7	9.7	7.6	8.55	10.0	7.65	8.0	7.2
8	8.2	7.5	8.5	9.9	7.6	7.85	7.15
9	8.3	7.6	8.6	12.5	7.55	7.8	7.1
10	8.2	7.55	8.8	13.0	7.55	7.7	7.1
11	8.3	7.55	8.95	12.0	7.6	7.65	7.15
12	8.5	7.6	9.2	11.0	7.55	7.5	7.4
13	8.4	7.6	9.45	10.4	7.55	7.45	7.15
14	8.25	7.65	9.4	10.75	7.5	7.45	7.05
15	8.35	7.75	9.35	11.55	7.45	7.4	7.05
16	9.5	7.85	9.1	11.35	7.3	7.35	7.1
17	10.1	7.6	9.3	10.4	7.3	7.3	7.05
18	9.9	7.6	9.45	9.8	7.35	7.3	7.05
19	9.4	7.65	9.5	9.4	7.5	7.25	7.05
20	9.1	7.7	9.2	9.1	7.4	7.25	7.05
21	8.8	7.8	8.9	8.9	7.4	7.25	6.95
22	11.1	7.9	8.8	8.75	7.35	7.35	.....
23	12.0	7.95	8.65	8.55	7.4	7.3	.....
24	11.35	8.0	8.5	8.45	7.4	7.3	.....
25	10.5	8.2	8.45	8.3	7.4	7.25	.....
26	9.7	8.4	8.35	8.2	7.35	7.15	.....
27	9.3	8.35	14.7	8.15	7.35	7.15	.....
28	9.0	8.0	15.45	8.0	7.5	7.1	.....
29	8.9	.....	15.6	7.95	7.4	7.1	.....
30	8.8	.....	13.6	7.9	7.35	7.2	.....
31	8.6	.....	16.25	.....	7.65	.....	.....

NOTE.—Discharge probably unaffected by ice conditions.

Rating table for West Branch White River at Indianapolis, Ind., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
6.90	240	8.20	1,080	9.50	2,420	11.00	5,820
7.00	280	8.30	1,170	9.60	2,540	11.80	6,230
7.10	325	8.40	1,260	9.70	2,670	12.00	6,650
7.20	375	8.50	1,350	9.80	2,800	12.20	7,090
7.30	430	8.60	1,450	9.90	2,930	12.40	7,540
7.40	490	8.70	1,550	10.00	3,070	12.60	8,000
7.50	550	8.80	1,650	10.20	3,350	12.80	8,470
7.60	615	8.90	1,750	10.40	3,650	13.00	8,950
7.70	680	9.00	1,850	10.60	3,970	14.00	11,570
7.80	750	9.10	1,960	10.80	4,310	15.00	14,570
7.90	830	9.20	2,070	11.00	4,670	16.00	18,000
8.00	910	9.30	2,180	11.20	5,040	16.50	19,830
8.10	990	9.40	2,300	11.40	5,420		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1906 and on the form of the 1905 rating curve. It is not very well defined.

Monthly discharge of West Branch White River at Indianapolis, Ind., for 1906.

[Drainage area, 1,520 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	6,650	1,080	2,490	1.64	1.89
February	1,350	550	791	.521	.54
March	18,900	870	3,940	2.60	3.00
April	19,600	830	4,290	2.82	3.15
May	790	430	566	.372	.43
June	1,600	325	632	.416	.46
July 1-21	490	260	342	.225	.18

NOTE.—Values are rated as follows: January and February, good; March and April, excellent; May, June, and July, fair.

EEL RIVER AT CATARACT, IND.

This station was established August 6, 1903, and was discontinued March 31, 1906. It is located 6 miles from Cloverdale, Ind., and one-half mile northeast of Cataract, Ind. It is 300 feet above a dam, below which there is a fall of 35 feet. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 85, where are given also references to publications that contain data for previous years. The data collected are valuable for water-power purposes.

Daily gage height, in feet, of Eel River, at Cataract, Ind., for 1906.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	2.8	2.9	3.2	17	4.0	2.9	2.8
2	3.0	2.7	3.3	18	4.1	2.8	2.7
3	3.2	2.6	3.4	19	4.2	2.7	2.7
4	3.4	.....	3.3	20	4.2	2.7	2.6
5	3.6	.....	3.3	21	4.1	2.6	2.6
6	3.7	.....	3.2	22	4.0	2.8	2.5
7	3.7	.....	3.2	23	4.0	2.9	2.5
8	3.7	.....	3.1	24	3.9	3.0	2.6
9	3.6	.....	3.0	25	3.9	2.9	2.7
10	3.6	2.7	3.0	26	3.8	2.9	3.3
11	3.6	2.7	3.1	27	3.7	2.9	4.1
12	3.6	2.7	3.1	28	3.6	3.0	4.4
13	3.6	2.6	3.0	29	3.4	.....	4.4
14	3.7	2.6	3.0	30	3.2	.....	4.6
15	3.8	2.8	2.9	31	3.0	.....	4.9
16	3.9	2.9	2.9				

NOTE.—River frozen February 4 to 9.

EAST BRANCH OF WHITE RIVER AT SHOALS, IND.

This station was established June 25, 1903, and was discontinued July 21, 1906. It is located at the highway bridge in the village of Shoals, Ind., 400 feet above the Baltimore and Ohio Southwestern Railroad bridge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 86, where are given also references to publications that contain data for previous years. The data collected are valuable for water-power purposes.

Discharge measurements of East Branch of White River at Shoals, Ind., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 15 [a]	Brennan and Kriegsman	341	943	64.90	2,550
March 1	E. F. Kriegsman	331	967	65.08	3,200
March 29	do	406	4,390	74.01	20,000
April 2	do	430	9,400	85.62	37,800
April 15	do	353	2,510	69.30	12,400

[a] Thin ice running.

Daily gage height, in feet, of East Branch of White River at Shoals, Ind., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	65.8	65.5	65.2	84.5	65.0	64.3	17	70.0	64.7	67.1	69.3	64.4	64.0
2	66.2	65.4	65.1	86.0	65.0	64.3	18	69.8	64.7	66.7	68.8	64.4	63.9
3	67.8	65.3	67.1	87.4	65.0	64.2	19	69.5	64.7	66.7	67.8	64.3	63.9
4	76.4	65.2	69.0	88.0	64.9	64.2	20	69.2	64.6	67.0	67.0	64.3	63.9
5	75.0	65.0	70.8	87.5	64.9	65.1	21	68.0	64.7	68.1	66.7	64.3	63.8
6	73.5	64.8	70.2	85.7	65.0	64.8	22	67.6	64.9	69.7	66.4	64.3	63.8
7	73.0	64.6	68.8	82.8	65.1	64.7	23	67.9	65.5	69.8	66.0	64.3	63.9
8	72.5	64.3	67.4	77.0	65.0	64.5	24	67.7	65.9	69.7	65.8	64.3	63.8
9	71.3	64.3	66.3	73.2	64.8	64.5	25	67.5	65.8	69.7	65.7	64.2	63.8
10	69.5	64.4	66.6	72.0	64.7	64.7	26	67.1	65.5	70.0	65.6	64.2	63.8
11	67.8	64.5	66.6	71.0	64.6	64.6	27	66.7	65.3	70.7	65.4	64.2	63.8
12	66.6	64.7	66.6	70.5	64.4	64.4	28	66.3	65.2	73.7	65.3	64.2	63.8
13	66.4	64.7	66.6	70.0	64.5	64.3	29	66.0	.....	74.4	65.2	64.1	63.8
14	66.2	64.7	66.7	69.8	64.5	64.2	30	65.8	.....	78.2	65.1	64.1	63.8
15	67.5	64.7	66.9	69.5	64.5	64.1	31	65.6	.....	82.5	.....	64.1	.....
16	69.1	64.8	67.0	69.2	64.4	64.0							

NOTE.—Slight ice conditions during part of February, but flow probably was not much affected thereby.

Rating table for East Branch of White River at Shoals, Ind., for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
63.80	880	65.00	2,920	66.20	6,360	67.80	9,700
63.90	1,000	65.10	3,180	66.30	6,580	68.00	10,080
64.00	1,130	65.20	3,460	66.40	6,800	68.20	10,440
64.10	1,270	65.30	3,750	66.50	7,020	68.40	10,840
64.20	1,410	65.40	4,050	66.60	7,240	68.60	11,220
64.30	1,560	65.50	4,360	66.70	7,460	68.80	11,590
64.40	1,720	65.60	4,670	66.80	7,680	69.00	11,950
64.50	1,890	65.70	4,980	66.90	7,900	70.00	13,750
64.60	2,070	65.80	5,280	67.00	8,100	71.00	15,400
64.70	2,260	65.90	5,580	67.20	8,500	72.00	17,000
64.80	2,460	66.00	5,860	67.40	8,900	73.00	18,500
64.90	2,680	66.10	6,120	67.60	9,300	74.00	20,000

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903 to 1906. It is well defined between gage heights 63.2 feet and 65.4 feet. Above gage height 72.0 feet the rating curve is a tangent, the difference being 150 per tenth.

Monthly discharge of East Branch of White River at Shoals, Ind., for 1906.

[Drainage area, 4,900 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	23,600	4,670	11,000	2.24	2.58
February	5,580	1,560	2,920	.596	.62
March	32,800	3,180	11,600	2.37	2.73
April	41,000	3,180	16,700	3.41	3.80
May	3,180	1,270	1,980	.404	.47
June	3,180	880	1,400	.285	.32

NOTE.—Discharge values were not corrected for the effect of ice conditions. Values for 1906 are excellent.

TENNESSEE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Tennessee River is formed by the junction of the French Broad and the Holston, about 4 miles above Knoxville, Tenn. It flows southwestward, crossing into Alabama about 40 miles below Chattanooga, Tenn., and, after crossing the northern part of Alabama, again enters Tennessee in Harding County. It then flows northward, crossing Tennessee and Kentucky, and enters Ohio River at Paducah, about 40 miles above Cairo. Its principal tributary on the north is Clinch River, which enters it near Kingston, Roan County, Tenn. The principal tributaries on the south are Hiwassee and Little Tennessee rivers. The Hiwassee rises in the northern part of Georgia and flows into the Tennessee about 30 miles above Chattanooga. Its principal tributaries are the Okoee and Nottely. Little Tennessee River rises in the northeast corner of Georgia, flows across the southwestern part of North Carolina, and enters the Tennessee near Loudon, Tenn. Its principal tributary is the Tuckasegee. French Broad River rises in the western part of North Carolina. Its principal tributaries are the Pigeon and the Nolichucky. Holston River rises in the western part of Virginia. Its principal tributary is Watauga River.

FRENCH BROAD RIVER AT HORSESHOE, N. C.

This station was established October 4, 1904, and was discontinued March 31, 1906. It is located at the steel highway bridge at Horseshoe, N. C. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 89, where are given also references to publications that contain data for previous years.

Discharge measurements of French Broad River at Horseshoe, N. C., for 1904 to 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1904.					
July 18	B. S. Drane	82	241	0.86	396
August 18	do	82	285	1.51	529
October 3	do	81	192	.51	290
December 7	do	81	318	1.91	584
1905.					
April 12	B. S. Drane	81	439	3.10	888
June 22	do	81	522	3.84	1,160
August 29	do	81	488	3.60	1,110
November 11	W. E. Hall	81	259	1.37	415
1906.					
March 6	W. E. Hall	81	613	4.62	1,410
March 6	do	81	613	4.62	1,420

Daily gage height, in feet, of French Broad River at Horseshoe, N. C., for 1906.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	3.6	6.7	3.6	17	4.4	4.0	5.5
2	3.4	6.3	3.4	18	4.2	3.8	4.9
3	7.1	5.7	3.7	19	4.2	3.8	7.0
4	12.7	5.5	5.5	20	3.9	3.6	9.9
5	13.0	5.2	5.4	21	3.8	3.8	6.8
6	7.5	5.0	4.8	22	8.2	5.5	5.9
7	5.9	4.9	4.4	23	16.0	4.2	5.5
8	5.4	4.8	4.6	24	16.0	4.0	4.9
9	5.0	4.6	4.8	25	14.0	3.9	4.8
10	4.5	4.4	4.5	26	10.0	3.8	4.6
11	4.2	4.2	4.3	27	7.8	3.8	4.5
12	5.5	4.4	4.0	28	7.2	3.7	4.6
13	5.0	4.4	3.8	29	7.1	.....	4.5
14	5.5	4.3	4.0	30	7.0	.....	7.8
15	4.8	4.2	7.3	31	6.9	.....	8.8
16	4.6	4.2	7.2				

Rating table for French Broad River at Horseshoe, N. C., 1904 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.30	242	1.50	473	2.70	785	3.90	1,165
0.40	258	1.60	496	2.80	815	4.00	1,200
0.50	275	1.70	519	2.90	845	4.20	1,270
0.60	292	1.80	542	3.00	875	4.40	1,340
0.70	310	1.90	566	3.10	905	4.60	1,410
0.80	328	2.00	590	3.20	935	4.80	1,480
0.90	347	2.10	615	3.30	965	5.00	1,550
1.00	367	2.20	640	3.40	995	5.20	1,630
1.10	387	2.30	665	3.50	1,025	5.40	1,710
1.20	408	2.40	695	3.60	1,060	6.00	1,960
1.30	429	2.50	725	3.70	1,095		
1.40	451	2.60	755	3.80	1,130		

NOTE.—The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1904, to 1906. It is well defined between gage heights 0.5 foot and 5.0 feet. Above 5.0 feet the rating curve is a tangent, the difference being 40 per tenth.

Monthly discharge of French Broad River at Horseshoe, N. C., 1904 to 1906.

[Drainage area, 325 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1904.					
October	275	242	256	0.788	0.91
November	710	250	346	1.06	1.18
December	1,950	284	480	1.48	1.71
1905.					
January	3,630	301	918	2.82	3.25
February	3,110	473	1,190	3.66	3.81
March	1,630	725	994	3.06	3.53
April	1,130	615	751	2.31	2.58
May	2,910	695	1,280	3.94	4.54
June	3,630	554	1,050	3.23	3.60
July	5,630	935	1,960	6.03	6.95
August	3,870	815	1,610	4.95	5.71
September	1,200	542	732	2.25	2.51
October	2,310	496	643	1.98	2.28
November	519	408	449	1.38	1.54
December	3,310	429	1,400	4.31	4.97
The year	5,630	301	1,080	3.33	45.27
1906.					
January	5,950	995	2,380	7.32	8.44
February	2,230	1,060	1,390	4.28	4.46
March	3,510	995	1,700	5.23	6.03

NOTE.—Values for 1904 to 1906 are good.

FRENCH BROAD RIVER NEAR ASHEVILLE, N. C.

This station is located at the steel highway bridge known as Smith Bridge, about 1 mile below the Southern Railway depot at Asheville, N. C., and near the end of the Patton avenue line of the Asheville Street Railway Company. The United States Weather Bureau maintains a station at this place, and furnishes gage height records to the United States Geological Survey. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 90, where are given also references to publications that contain data for previous years.

Discharge measurements of French Broad River near Asheville, N. C., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 1	W. E. Hall	314	1,100	0.43	2,140
April 16	O. P. Hall	336	1,830	2.42	6,300
June 16	W. E. Hall	342	2,400	3.87	10,400

Daily gage height, in feet, of French Broad River near Asheville, N. C., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.3	2.0	0.4	1.8	0.6	0.1	0.5	0.8	2.2	3.4	0.7	0.7
2	.2	1.8	.4	1.6	.5	.5	.3	.9	2.0	3.4	.6	.6
3	.3	1.6	.5	1.0	.5	.5	.5	.8	1.7	4.3	.5	.5
4	4.0	1.2	2.0	1.0	.5	.4	.7	.7	1.1	5.3	.5	.5
5	3.8	1.1	1.4	.8	.5	.4	.7	.6	1.6	4.9	.5	.5
6	2.9	1.0	1.0	.8	.5	1.4	.7	.5	2.0	4.5	.5	.4
7	1.4	1.0	.6	.7	.6	.8	.5	.8	1.5	3.6	.4	.4
8	1.2	1.0	.6	.7	.5	.4	.3	.7	1.3	3.2	.3	.4
9	1.0	.9	1.0	.6	.3	.4	1.0	.3	1.0	2.6	.3	.4
10	.7	.8	.8	.9	.3	.8	.5	.2	.7	2.3	.2	.4
11	.3	.6	.6	.7	.2	.7	.3	.2	.6	2.0	.2	1.6
12	1.0	.7	.5	.5	.2	.6	.2	.1	.7	1.8	.2	1.1
13	1.1	.9	.5	.5	.2	1.8	.2	.1	1.5	1.7	.2	.8
14	1.3	.7	.5	.6	.1	3.6	.2	1.0	.8	1.5	.1	.6
15	1.1	.6	1.0	3.2	.1	3.5	1.4	1.1	.6	1.4	.1	.5
16	1.0	.5	2.2	2.6	.1	4.2	2.1	.8	.5	1.3	.1	.5
17	.8	.6	1.4	1.6	.1	3.4	1.6	.8	.4	1.3	.1	.6
18	.7	.6	1.0	1.2	.1	3.5	2.5	1.0	.7	1.4	2.0	1.2
19	.7	.6	.9	1.0	.0	2.0	2.9	1.4	5.7	2.6	5.0	.9
20	.5	.5	2.6	.9	.0	1.5	2.1	1.0	5.1	2.0	4.1	.9
21	.5	.5	2.0	.8	.0	1.1	1.5	1.4	4.7	1.6	3.6	.9
22	.8	1.1	1.5	.8	.0	.4	1.5	.7	4.0	1.4	3.1	.8
23	7.8	1.8	1.1	.7	−0.1	.9	2.5	1.0	2.8	1.3	3.0	.7
24	7.0	.6	1.0	.6	−0.1	.9	1.6	.8	2.6	1.3	1.5	.6
25	5.0	.6	.9	.5	−0.2	1.4	1.1	.8	2.1	1.2	1.1	.5
26	3.6	.5	.8	.5	.0	1.1	1.1	.6	2.1	1.1	1.0	.5
27	3.5	.5	.8	.5	1.2	.7	1.4	.9	2.1	1.0	.9	.4
28	2.1	.5	.8	.5	1.0	.8	1.1	2.6	2.2	.9	.9	.4
29	2.2	.....	.9	.5	.6	.6	.7	2.5	3.5	.9	.9	.4
30	2.1	.....	1.5	.8	.3	.6	.8	2.8	3.5	.8	.8	.4
31	2.0	.....	2.2	.....	.1	.....	.7	3.2	.....	.8	.....	1.6

Rating table for French Broad River near Asheville, N. C., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
−0.20	1,330	1.00	3,170	2.20	5,730	3.80	10,370
−0.10	1,460	1.10	3,350	2.30	5,980	4.00	11,040
0.00	1,590	1.20	3,540	2.40	6,240	4.20	11,730
0.10	1,730	1.30	3,730	2.50	6,500	4.40	12,420
0.20	1,870	1.40	3,930	2.60	6,770	4.60	13,150
0.30	2,020	1.50	4,130	2.70	7,040	4.80	13,890
0.40	2,170	1.60	4,340	2.80	7,320	5.00	14,650
0.50	2,330	1.70	4,660	2.90	7,600	5.20	15,420
0.60	2,490	1.80	4,780	3.00	7,890	5.40	16,200
0.70	2,650	1.90	5,010	3.20	8,480	5.60	17,000
0.80	2,820	2.00	5,240	3.40	9,090	5.80	17,800
0.99	2,990	2.10	5,480	3.60	9,720		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 11 discharge measurements made during 1904 to 1906. It is well defined between gage heights −1.0 foot and +5.0 feet. Above gage height 5.40 the rating curve is a tangent, the difference being 400 per tenth.

Monthly discharge of French Broad River near Asheville, N. C., for 1906.

[Drainage area, 987 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	25,800	1,870	6,020	6.10	7.03
February	5,240	2,330	3,010	3.05	3.18
March	6,770	2,170	3,400	3.44	3.97
April	8,480	2,330	3,210	3.25	3.63
May	3,540	1,330	2,010	2.04	2.35
June	11,700	1,730	4,080	4.13	4.61
July	7,600	1,870	3,440	3.49	4.02
August	8,480	1,730	3,330	3.37	3.88
September	17,400	2,170	5,780	5.86	6.54
October	15,800	2,820	6,050	6.13	7.07
November	14,600	1,730	3,820	3.87	4.32
December	4,340	2,170	2,610	2.64	3.04
The year	25,800	1,330	3,900	3.94	53.64

NOTE.—Values for 1906 are excellent.

TENNESSEE RIVER NEAR KNOXVILLE, TENN.

This station is located at the Gay street or county highway bridge. Gage heights are furnished by United States Weather Bureau. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 96, where are given also references to publications that contain data for previous years.

Discharge measurements of Tennessee River near Knoxville, Tenn., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 23	O. P. Hall	773	4,920	3.03	13,400
June 15	do	880	6,670	5.45	24,900
October 19	F. A. Murray	839	4,950	2.78	12,500

Daily gage height, in feet, of Tennessee River near Knoxville, Tenn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.1	6.6	2.7	5.4	2.2	1.7	1.9	6.5	9.3	7.0	2.2	2.9
2	1.9	6.0	2.6	5.0	2.5	2.0	1.7	4.7	7.1	5.8	2.1	2.8
3	1.9	5.3	2.7	4.4	2.5	2.1	1.6	4.3	5.1	5.4	2.0	2.6
4	3.5	4.6	3.2	3.9	3.0	2.0	1.5	4.7	4.5	7.7	2.0	2.6
5	7.4	4.0	3.8	3.5	3.7	2.0	2.2	4.3	4.8	8.4	1.9	2.5
6	7.3	3.7	4.0	3.4	4.9	1.9	1.9	3.7	7.4	8.1	1.8	2.5
7	5.5	3.6	3.4	3.4	6.1	2.4	1.8	3.3	8.4	8.1	1.8	2.5
8	3.9	3.4	3.1	3.5	7.3	2.2	1.9	3.1	5.9	6.7	1.8	2.4
9	3.7	3.1	2.9	3.8	6.3	1.9	2.4	3.0	5.2	5.7	1.7	2.4
10	3.3	2.9	2.9	5.2	4.6	1.6	2.4	2.4	4.3	4.8	1.7	2.4
11	2.9	2.8	2.8	5.2	3.8	1.5	2.2	2.3	3.6	4.1	1.7	2.2
12	2.8	2.6	2.6	4.4	3.4	1.7	1.9	2.1	3.1	3.7	1.8	2.4
13	3.0	2.6	2.4	3.7	3.0	1.7	1.6	2.1	3.4	3.4	2.3	2.8
14	3.7	2.6	2.3	3.3	2.7	3.0	1.4	2.3	3.1	3.1	2.7	2.5
15	4.2	2.7	3.4	3.8	2.5	5.6	2.1	3.1	2.8	2.9	2.4	2.4
16	4.9	2.7	7.3	6.0	2.3	5.4	2.1	4.2	2.5	2.7	2.1	2.3
17	4.9	2.7	8.0	8.1	2.1	5.9	3.8	5.2	2.2	2.6	2.0	2.3
18	4.3	2.7	6.5	5.9	2.0	5.0	6.5	4.7	2.0	2.5	2.3	3.5
19	3.9	2.5	4.9	4.7	1.9	4.0	5.0	5.0	1.9	2.7	10.0	3.8
20	3.7	2.4	4.5	4.0	1.9	3.3	5.2	4.2	10.9	4.2	23.0	4.3
21	3.5	2.3	5.2	3.6	1.8	3.0	4.8	4.1	7.9	8.5	17.7	3.9
22	3.2	2.6	4.9	3.4	1.9	2.7	4.6	3.9	6.7	7.2	11.4	3.8
23	4.7	3.0	4.2	3.0	1.7	2.7	5.0	3.7	5.8	5.2	7.5	3.7
24	20.1	3.1	3.9	2.9	1.6	2.7	4.7	4.1	5.0	4.2	5.7	3.5
25	18.1	3.0	3.6	2.7	1.5	3.2	3.9	5.2	4.3	3.7	4.8	3.1
26	9.9	2.8	3.5	2.5	1.4	3.6	3.2	3.9	4.1	3.3	4.2	2.6
27	7.9	2.8	3.6	2.6	1.4	3.2	3.0	3.2	3.6	3.0	3.8	2.1
28	7.3	2.7	4.0	2.3	2.2	3.0	2.8	5.8	3.3	2.8	3.5	3.5
29	7.2	.....	4.0	2.3	3.0	2.5	3.2	4.4	3.7	2.6	3.3	10.3
30	7.0	.....	4.2	2.2	2.5	2.1	3.1	7.7	4.6	2.4	3.1	10.9
31	6.7	.....	4.6	.....	2.0	.....	5.6	9.8	.....	2.3	.....	9.8

Rating table for Tennessee River near Knoxville, Tenn., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	6,590	2.80	12,360	4.20	18,240	6.20	26,660
1.50	6,970	2.90	12,780	4.30	18,660	6.40	27,520
1.60	7,360	3.00	13,200	4.40	19,080	6.60	28,380
1.70	7,760	3.10	13,620	4.50	19,500	6.80	29,240
1.80	8,170	3.20	14,040	4.60	19,920	7.00	30,100
1.90	8,580	3.30	14,460	4.70	20,340	8.00	34,400
2.00	9,000	3.40	14,880	4.80	20,760	9.00	38,900
2.10	9,420	3.50	15,300	4.90	21,180	10.00	43,600
2.20	9,840	3.60	15,720	5.00	21,600	11.00	48,500
2.30	10,260	3.70	16,140	5.20	22,440	12.00	53,700
2.40	10,680	3.80	16,560	5.40	23,280	13.00	59,200
2.50	11,100	3.90	16,980	5.60	24,120	14.00	65,000
2.60	11,520	4.00	17,400	5.80	24,960	15.00	71,000
2.70	11,940	4.10	17,820	6.00	25,800	16.00	77,000

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1899 to 1906. It is well defined up to gage height of 24 feet. Above gage height 14.0 feet the rating curve is a tangent, the difference being 600 per tenth.

Monthly discharge of Tennessee River near Knoxville, Tenn., for 1906.

[Drainage area, 8,990 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	102,000	8,580	25,300	2.81	3.24
February	28,400	10,300	14,400	1.60	1.67
March	34,400	10,300	17,100	1.90	2.19
April	34,800	9,840	17,200	1.91	2.13
May	31,400	6,590	12,800	1.42	1.64
June	25,400	6,970	12,600	1.40	1.56
July	28,000	6,590	13,500	1.50	1.73
August	42,600	9,420	18,400	2.05	2.36
September	48,000	8,580	21,200	2.36	2.63
October	36,600	10,300	20,300	2.26	2.61
November	119,000	7,760	20,700	2.30	2.57
December	48,000	9,420	15,800	1.76	2.03
The year	119,000	6,590	17,400	1.94	26.36

NOTE.—Values for 1906 are excellent.

TENNESSEE RIVER AT CHATTANOOGA, TENN.

This station was established in 1879, at the foot of Lookout street, just below Chattanooga Island, by the Signal Corps of the United States Army, but since July 1, 1891, it has been in charge of the Weather Bureau. Gage heights are furnished to the Geological Survey through L. M. Pindell. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 99, where are given also references to publications that contain data for previous years.

Discharge measurements of Tennessee River at Chattanooga, Tenn., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 9	F. A. Murray	1,120	13,100	8.36	52,800
May 23	O. P. Hall	1,040	7,690	3.40	19,800
June 21	do	1,080	9,810	5.45	31,300
October 17	F. A. Murray	1,080	10,100	5.59	31,900

Daily gage height, in feet, of Tennessee River at Chattanooga, Tenn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.5	9.6	5.3	14.8	4.9	4.1	4.6	7.7	13.0	13.9	4.5	6.3
2	5.1	9.1	5.2	12.4	4.8	3.8	4.2	9.0	11.7	19.2	4.4	6.2
3	5.0	8.8	5.5	10.6	4.8	4.1	3.9	9.5	10.3	19.3	4.3	5.7
4	8.3	8.3	8.2	9.2	4.9	4.3	3.7	8.2	8.9	17.9	4.2	5.6
5	12.0	7.7	9.4	8.3	5.1	4.3	3.5	7.6	7.7	13.8	3.9	5.5
6	12.9	7.0	8.6	7.5	5.5	4.3	3.5	7.9	7.9	13.6	3.9	5.3
7	12.1	6.5	7.7	7.1	6.0	4.1	3.7	7.3	9.1	15.3	3.9	5.3
8	10.9	6.1	7.2	6.9	7.2	3.9	3.7	6.9	10.4	15.4	3.8	5.4
9	9.1	5.8	6.7	6.9	8.2	3.9	4.4	6.2	10.4	13.4	3.7	5.5
10	8.5	5.6	6.3	7.4	8.9	3.8	5.4	5.8	9.3	11.4	3.6	5.3
11	7.6	5.3	5.9	8.6	8.3	3.6	5.5	5.5	9.2	9.9	3.5	5.2
12	7.0	5.0	5.7	9.3	7.0	3.2	5.2	5.2	8.8	8.6	3.5	5.6
13	6.7	4.8	5.4	8.7	6.1	3.2	4.5	4.9	8.0	7.6	3.5	5.6
14	6.9	4.7	5.1	8.1	5.5	4.4	4.7	4.7	7.0	7.0	3.7	5.5
15	6.9	4.7	5.7	8.4	5.1	5.4	6.7	5.1	6.2	6.4	4.0	5.4
16	7.4	4.6	7.3	8.7	4.8	7.8	8.7	6.3	5.7	6.0	4.1	5.3
17	8.0	4.6	9.9	9.4	4.5	9.2	7.9	7.3	5.2	5.7	4.4	5.1
18	8.9	4.5	10.6	10.1	4.2	8.6	9.3	7.2	4.9	5.6	4.4	5.8
19	8.7	4.5	10.4	10.2	4.0	7.7	14.2	7.6	4.8	7.0	8.2	8.5
20	8.0	4.4	10.7	8.9	3.8	6.8	15.0	7.7	6.1	7.1	22.1	9.2
21	7.5	4.4	10.6	7.7	3.7	6.0	10.8	7.7	8.1	6.9	31.6	8.9
22	7.3	4.9	9.7	7.0	3.6	5.5	10.3	7.3	11.1	7.0	33.3	9.3
23	8.7	5.5	8.9	6.5	3.5	5.1	12.0	6.9	10.3	8.9	31.0	8.4
24	12.4	6.0	8.1	6.0	3.5	4.9	13.7	6.5	9.2	8.4	22.0	7.7
25	17.4	5.8	7.4	5.7	3.4	6.0	12.3	6.5	8.5	7.4	13.0	7.3
26	21.4	5.5	6.9	5.4	3.3	6.6	9.7	7.1	7.7	6.6	9.7	6.6
27	18.9	5.3	6.7	5.2	3.3	6.7	8.1	7.3	7.0	6.0	8.6	6.1
28	13.4	5.2	6.9	5.3	3.7	6.2	7.5	6.7	6.6	5.6	7.7	5.8
29	11.1	.....	7.6	5.6	3.9	5.5	7.2	6.5	5.9	5.2	7.2	5.9
30	10.2	.....	9.6	5.3	4.1	5.0	6.6	7.7	6.1	4.9	6.8	10.1
31	10.1	.....	13.7	.....	4.6	.....	7.0	9.7	.....	4.7	.....	16.3

Rating table for Tennessee River at Chattanooga, Tenn., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.20	17,920	4.00	22,360	4.80	27,070	5.60	32,120
3.30	18,460	4.10	22,940	4.90	27,680	5.70	32,780
3.40	19,000	4.20	23,520	5.00	28,300	5.80	33,450
3.50	19,550	4.30	24,100	5.10	28,920	5.90	34,120
3.60	20,100	4.40	24,690	5.20	29,550	6.00	34,800
3.70	20,660	4.50	25,280	5.30	30,180	7.00	41,600
3.80	21,220	4.60	25,870	5.40	30,820	8.00	48,400
3.90	21,790	4.70	26,470	5.50	31,470		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1893 to 1906. It is well defined up to gage height of 20 feet. Above gage height 6.0 feet the rating curve is a tangent, the difference being 680 per tenth.

Monthly discharge of Tennessee River at Chattanooga, Tenn., for 1906.

[Drainage area, 21,400 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	140,000	28,300	60,600	2.83	3.26
February	59,300	24,700	34,100	1.59	1.66
March	87,200	28,900	47,300	2.21	2.55
April	94,600	29,600	48,700	2.28	2.54
May	54,500	18,500	28,600	1.34	1.54
June	56,600	17,900	30,400	1.42	1.58
July	96,000	19,600	44,300	2.07	2.39
August	60,000	26,500	41,800	1.95	2.25
September	82,400	27,100	49,600	2.32	2.59
October	125,000	26,500	58,900	2.75	3.17
November	220,000	19,600	56,300	2.63	2.93
December	105,000	28,900	40,100	1.87	2.16
The year	220,000	17,900	45,100	2.10	28.62

NOTE.—Values for 1906 are excellent.

DAVIDSONS RIVER NEAR DAVIDSONS RIVER, N. C.

This station was established May 19, 1904. It is located at English Bridge, about 2 miles from Davidsons River, N. C., and about 500 feet above the mouth of Avery Creek. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 101, where are given also references to publications that contain data for previous years.

Measurements of Davidsons River near Davidsons River, N. C.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 6	W. E. Hall	67	124	1.25	129
June 15	do	77	236	2.74	1,020

Daily gage height, in feet of Davidsons River near Davidsons River, N. C., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.05	1.45	1.1	1.5	1.1	1.05	1.25	1.4	1.6	2.1	1.2	1.2
2	1.0	1.4	1.1	1.45	1.1	1.2	1.5	1.4	1.5	2.6	1.2	1.2
3	2.5	1.35	1.9	1.4	1.1	1.3	1.65	1.45	1.45	3.2	1.2	1.2
4	1.9	1.3	1.45	1.35	1.1	1.25	1.6	1.4	1.4	2.5	1.2	1.15
5	1.55	1.3	1.3	1.3	1.1	1.65	1.45	1.4	1.95	2.1	1.15	1.15
6	1.4	1.3	1.25	1.3	1.1	1.5	1.4	1.45	1.75	2.1	1.15	1.15
7	1.3	1.25	1.2	1.25	1.1	1.3	1.35	1.42	1.6	1.9	1.15	1.25
8	1.25	1.25	1.35	1.25	1.05	1.2	1.3	1.35	1.55	1.8	1.15	1.15
9	1.25	1.25	1.25	1.3	1.05	1.15	1.4	1.3	1.75	1.75	1.1	1.1
10	1.2	1.2	1.2	1.25	1.05	1.55	1.3	1.3	1.4	1.65	1.1	1.5
11	1.15	1.2	1.2	1.2	1.0	1.45	1.25	1.25	1.35	1.65	1.1	1.35
12	1.25	1.25	1.15	1.2	1.0	1.75	1.25	1.2	1.35	1.6	1.1	1.3
13	1.25	1.2	1.15	1.2	1.0	3.5	1.2	1.3	1.4	1.55	1.1	1.2
14	1.3	1.2	1.15	1.7	1.0	2.2	1.2	1.25	1.3	1.5	1.1	1.2
15	1.2	1.2	1.7	1.7	1.0	2.5	2.15	1.4	1.3	1.5	1.1	1.15
16	1.25	1.15	1.35	1.5	1.0	2.1	1.85	1.3	1.3	1.45	1.15	1.1
17	1.2	1.15	1.3	1.4	.95	2.0	1.95	1.6	1.25	1.45	1.15	1.25
18	1.15	1.15	1.25	1.35	.95	1.8	1.85	1.5	2.7	1.7	2.85	1.25
19	1.15	1.1	1.6	1.3	1.0	1.7	1.7	1.6	3.0	1.55	2.45	1.25
20	1.15	1.1	1.5	1.3	1.0	1.6	1.6	1.5	2.0	1.5	1.8	1.25
21	1.15	1.45	1.4	1.25	.95	1.5	1.5	1.4	1.8	1.45	1.6	1.2
22	4.1	1.25	1.35	1.25	.95	1.45	1.45	1.35	1.7	1.4	1.5	1.2
23	2.6	1.15	1.3	1.2	.95	1.4	1.4	1.35	1.85	1.4	1.4	1.15
24	2.05	1.15	1.25	1.2	.95	1.45	1.4	1.45	1.75	1.35	1.4	1.2
25	1.8	1.15	1.25	1.2	.9	1.4	1.4	1.35	1.8	1.35	1.3	1.85
26	1.75	1.1	1.2	1.15	1.7	1.35	1.65	1.45	1.7	1.3	1.3	1.9
27	1.6	1.2	1.3	1.15	1.6	1.3	1.7	1.4	1.75	1.3	1.3	1.95
28	1.55	1.1	1.2	1.15	1.4	1.25	1.65	1.35	2.0	1.3	1.25	1.2
29	1.5	.....	1.75	1.15	1.25	1.25	1.5	1.5	2.5	1.25	1.2	1.1
30	1.5	.....	2.0	1.15	1.15	1.25	1.45	1.5	2.6	1.25	1.2	1.2
31	1.5	.....	1.7	.....	1.1	.....	1.4	1.8	.....	1.25	.....	1.95

Rating table for Davidsons River near Davidsons River, N. C., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	60	1.50	210	2.10	520	2.70	985
1.00	79	1.60	250	2.20	590	2.80	1,075
1.10	100	1.70	295	2.30	660	2.90	1,170
1.20	122	1.80	345	2.40	735	3.00	1,265
1.30	147	1.90	400	2.50	815	3.20	1,460
1.40	176	2.00	460	2.60	895	3.40	1,660

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904 to 1906. It is well defined between gage heights 0.7 foot and 1.3 feet. Above gage height 3.1 feet the rating curve is a tangent, the difference being 100 per tenth.

Monthly discharge of Davidsons River near Davidsons River, N. C., for 1906.

[Drainage area, 41 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft per sq. mile.	Depth in inches.
January	2,360	79	297	7.24	8.35
February	193	100	130	3.17	3.30
March	460	100	177	4.32	4.98
April	295	111	152	3.71	4.14
May	295	60	102	2.49	2.87
June	1,760	90	293	7.15	7.98
July	555	122	226	5.51	6.35
August	400	122	189	4.61	5.32
September	1,260	134	356	8.68	9.68
October	1,460	134	325	7.93	9.14
November	1,120	100	191	4.66	5.20
December	430	100	162	3.95	4.55
The year	2,360	60	217	5.28	71.86

NOTE.—Values are rated as follows: January, June, September, and October, good; remaining months, excellent.

NORTH FORK OF MILLS RIVER AT PINKBED, N. C.

This station was established May 18, 1904. It is located at the wagon bridge in the village of Pinkbed, N. C. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 105, where are given also references to publications that contain data for previous years.

Discharge measurements of North Fork of Mills River at Pinkbed, N. C., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet*	*Sec.-ft.*
June 14	W. E. Hall	38	81	2.22	351
September 15	do	39	40	1.19	92
September 15	do	39	41	1.19	93

Daily gage height, in feet, of North Fork of Mills River at Pinkbed, N. C., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.9	1.45	1.0	1.5	1.05	0.9	1.2	1.1	1.5	2.3	1.25	1.25
2	.9	1.4	.95	1.4	1.0	1.1	1.15	1.1	1.4	2.3	1.2	1.2
3	2.2	1.35	1.5	1.3	1.0	.9	1.15	1.15	1.3	3.1	1.2	1.2
4	2.0	1.35	1.3	1.25	1.0	1.1	1.1	1.1	1.25	2.8	1.2	1.2
5	1.55	1.3	1.1	1.3	1.0	1.2	1.1	1.1	1.45	2.45	1.2	1.2
6	1.4	1.25	1.1	1.25	1.0	1.1	1.1	1.1	1.45	2.3	1.2	1.15
7	1.3	1.25	1.1	1.2	1.0	1.0	1.1	1.1	1.4	2.1	1.2	1.15
8	1.2	1.2	1.1	1.15	1.0	1.0	1.1	1.1	1.3	1.95	1.15	1.15
9	1.1	1.15	1.1	1.1	1.0	1.0	1.2	1.1	1.4	1.85	1.15	1.15
10	1.1	1.1	1.05	1.1	.95	1.0	1.1	1.05	1.35	1.8	1.15	1.15
11	1.1	1.1	1.0	1.1	.95	1.1	1.1	1.0	1.25	1.7	1.1	1.15
12	1.2	1.15	1.0	1.1	.9	1.2	1.1	1.0	1.2	1.65	1.1	1.1
13	1.15	1.1	1.0	1.1	.9	3.7	1.05	1.0	1.2	1.6	1.1	1.1
14	1.2	1.1	1.0	1.3	.9	2.4	1.05	1.1	1.3	1.55	1.1	1.1
15	1.15	1.1	1.5	1.8	.9	3.7	1.5	1.1	1.2	1.55	1.1	1.1
16	1.15	1.05	1.15	1.5	.85	2.3	1.45	1.1	1.2	1.5	1.1	1.1
17	1.1	1.05	1.1	1.4	.75	2.1	1.3	1.1	1.15	1.5	1.1	1.1
18	1.1	1.05	1.05	1.3	.75	1.9	1.4	1.1	2.0	1.55	1.4	1.1
19	1.1	1.05	1.6	1.3	.7	1.7	1.6	1.1	3.1	1.6	2.6	1.1
20	1.05	1.00	1.4	1.25	.8	1.6	1.55	1.05	2.2	1.55	1.7	1.15
21	1.05	1.3	1.4	1.2	.8	1.5	1.4	1.15	1.9	1.5	1.6	1.15
22	4.0	1.1	1.35	1.15	.8	1.5	1.4	1.1	1.8	1.45	1.5	1.15
23	3.0	1.05	1.2	1.15	.8	1.4	1.3	1.05	1.7	1.4	1.5	1.1
24	2.2	1.0	1.1	1.1	.8	1.4	1.2	1.05	1.65	1.4	1.4	1.1
25	1.9	1.0	1.1	1.1	.75	1.35	1.2	1.0	1.7	1.4	1.35	1.1
26	1.8	1.0	1.1	1.1	1.6	1.3	1.2	1.0	1.6	1.35	1.3	1.1
27	1.6	1.1	1.15	1.1	1.1	1.3	1.2	1.05	1.65	1.3	1.3	1.1
28	1.55	1.0	1.1	1.1	1.05	1.25	1.15	1.5	1.8	1.3	1.3	1.1
29	1.5	.....	1.55	1.05	1.0	1.2	1.1	1.6	2.4	1.3	1.25	1.1
30	1.5	.....	1.8	1.05	.9	1.2	1.1	1.7	2.4	1.25	1.25	1.1
31	1.5	.....	1.6	.....	.9	.....	1.1	1.8	.....	.....	.....	1.8

Rating table for North Fork of Mills River at Pinkbed, N. C., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.70	35	1.60	175	2.50	440	3.40	830
0.80	45	1.70	200	2.60	475	3.50	880
0.90	56	1.80	225	2.70	515	3.60	930
1.00	68	1.90	250	2.80	555	3.70	990
1.10	81	2.00	280	2.90	595	3.80	1,050
1.20	95	2.10	310	3.00	640	3.90	1,110
1.30	110	2.20	340	3.10	685	4.00	1,170
1.40	130	2.30	370	3.20	730		
1.50	150	2.40	405	3.30	780		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904 to 1906. It is fairly well defined between gage heights 0.5 foot and 1.2 feet.

Monthly discharge of North Fork of Mills River at Pinkbed, N. C., for 1906.

[Drainage area, 24 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	1,170	56	185	7.71	8.89
February	140	68	88.6	3.69	3.84
March	225	62	102	4.25	4.90
April	225	74	102	4.25	4.74
May	175	35	61.5	2.56	2.95
June	990	56	193	8.04	8.97
July	175	74	100	4.17	4.81
August	225	68	92.0	3.83	4.42
September	685	88	190	7.92	8.84
October	685	102	221	9.21	10.62
November	475	81	119	4.96	5.53
December	225	81	90.4	3.77	4.35
The year	1,170	35	129	5.03	72.86

NOTE.—Values for 1906 are good.

SOUTH FORK OF MILLS RIVER NEAR SITTON, N. C.

This station was established May 18, 1904. It is located at Sycamore Church, about 1 mile below Sitton's mill, Sitton, N. C. The conditions at this station and the bench marks are described in Water Supply Paper No. 169, page 107, where are given also references to publications that contain data for previous years.

Discharge measurements of South Fork of Mills River near Sitton, N. C., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 14	W. E. Hall	55	183	3.38	730
September 15	do	50	100	1.61	174
September 15	do	50	97	1.61	170

Daily gage height, in feet, of South Fork of Mills River near Sitton, N. C., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.15	1.8	1.35	2.0	1.45	1.3	1.55	1.6	2.15	3.0	1.65	1.65
2	1.15	1.75	1.35	1.85	1.4	1.5	1.5	1.55	1.9	3.8	1.6	1.6
3	3.0	1.65	2.3	1.75	1.4	1.9	1.7	1.6	1.85	5.2	1.6	1.6
4	2.55	1.6	1.9	1.7	1.4	1.7	1.65	1.6	1.75	4.0	1.6	1.6
5	2.0	1.6	1.7	1.65	1.35	2.1	1.55	1.5	2.6	3.2	1.6	1.55
6	1.75	1.55	1.6	1.6	1.35	2.0	1.5	1.5	2.35	3.3	1.55	1.6
7	1.6	1.5	1.55	1.6	1.35	1.7	1.5	1.55	2.2	2.8	1.55	1.6
8	1.5	1.5	1.7	1.55	1.3	1.55	1.65	1.45	2.0	2.65	1.5	1.55
9	1.4	1.5	1.55	1.55	1.3	1.7	1.65	1.4	1.9	2.5	1.5	1.5
10	1.4	1.45	1.5	1.55	1.3	2.1	1.5	1.4	1.8	2.35	1.5	1.75
11	1.35	1.45	1.5	1.5	1.3	1.85	1.45	1.35	1.7	2.3	1.5	1.8
12	1.5	1.5	1.45	1.5	1.3	2.4	1.4	1.3	1.7	2.25	1.5	1.6
13	1.4	1.45	1.4	1.45	1.25	5.8	1.4	1.4	1.8	2.1	1.45	1.6
14	1.5	1.45	1.4	2.5	1.25	3.7	1.9	1.55	1.7	2.05	1.45	1.55
15	1.4	1.45	2.05	2.3	1.25	4.2	2.4	1.5	1.65	2.0	1.45	1.5
16	1.4	1.4	1.7	1.9	1.25	3.7	2.1	1.45	1.6	1.95	1.45	1.5
17	1.35	1.4	1.6	1.8	1.2	2.85	2.1	1.9	1.6	2.0	1.55	1.65
18	1.3	1.4	1.55	1.7	1.2	2.45	2.1	1.75	4.0	2.35	4.0	1.6
19	1.3	1.35	2.35	1.6	1.2	2.3	2.35	1.55	4.8	2.2	3.9	1.55
20	1.3	1.35	2.0	1.6	1.2	2.1	2.1	2.7	3.2	2.05	2.65	1.6
21	1.25	1.5	1.8	1.55	1.2	2.0	2.0	1.9	2.65	2.0	2.3	1.6
22	5.6	1.5	1.7	1.55	1.2	1.9	1.85	1.8	2.5	1.95	2.1	1.55
23	4.3	1.4	1.65	1.5	1.15	1.8	1.75	1.6	2.3	1.9	2.0	1.5
24	2.9	1.4	1.6	1.5	1.15	1.8	1.7	1.75	2.3	1.9	1.9	1.5
25	2.45	1.4	1.55	1.45	1.15	1.8	1.65	1.55	2.35	1.85	1.85	1.6
26	2.4	1.35	1.5	1.4	1.8	1.8	1.9	1.65	2.2	1.8	1.8	1.9
27	2.2	1.4	1.55	1.45	2.25	1.65	1.75	1.75	2.25	1.8	1.75	1.6
28	2.0	1.35	1.55	1.4	1.8	1.7	1.65	2.4	2.45	1.75	1.7	1.5
29	1.9	.....	2.2	1.4	1.5	1.6	1.6	2.9	3.9	1.7	1.7	1.4
30	1.85	.....	2.6	1.4	1.4	1.6	1.55	2.3	3.4	1.7	1.65	1.4
31	1.85	.....	2.25	.....	1.35	.....	1.55	2.6	.....	1.7	.....	3.2

Rating table for South Fork of Mills River near Sitton, N. C., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	90	1.90	250	2.70	480	3.50	780
1.20	107	2.00	275	2.80	515	3.60	825
1.30	125	2.10	300	2.90	550	3.70	870
1.40	145	2.20	325	3.00	585	3.80	915
1.50	165	2.30	355	3.10	620	3.90	960
1.60	185	2.40	385	3.20	660	4.00	1,005
1.70	205	2.50	415	3.30	700	4.20	1,100
1.80	225	2.60	445	3.40	740	4.40	1,200

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904 to 1906. It is well defined between gage heights 0.7 foot and 1.7 feet. Above gage height 4.1 feet the rating curve is a tangent, the difference being 50 per tenth.

Monthly discharge of South Fork of Mills River near Sitton, N. C., for 1906.

[Drainage area, 40.5 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	1,800	98	306	7.56	8.72
February	225	135	161	3.98	4.14
March	445	135	216	5.33	6.14
April	415	145	197	4.86	5.42
May	340	98	137	3.38	3.90
June	1,900	125	378	9.33	10.41
July	385	145	218	5.38	6.20
August	550	125	222	5.48	6.32
September	1,400	185	403	9.95	11.10
October	1,600	205	414	10.22	11.78
November	1,000	155	260	6.42	7.16
December	660	145	197	4.86	5.60
The year	1,900	98	259	6.40	86.89

NOTE.—Values for 1906 are excellent.

NOLICHUCKY RIVER NEAR GREENEVILLE, TENN.

This station was established May 7, 1903. It is located at Jones's bridge, 5 miles southeast of Greeneville, Tenn. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 112, where are given also references to publications that contain data for previous years.

Discharge measurements of Nolichucky River near Greeneville, Tenn., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 25	O. P. Hall	267	764	0.60	1,060
October 20	F. A. Murray	275	1,490	3.21	6,020
October 20	do	275	1,460	3.06	5,770

Daily gage height, in feet, of Nolichucky River near Greeneville, Tenn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.6	2.35	1.0	2.0	0.95	0.6	0.7	1.1	3.0	2.55	1.0	1.15
2	.55	2.1	1.0	1.7	1.0	.7	.7	1.2	2.25	2.6	.95	1.1
3	55	1.85	1.05	1.5	1.05	.95	.6	2.7	1.9	3.4	.95	1.05
4	3.8	1.65	2.15	1.35	1.5	.7	.7	2.0	3.2	4.4	.9	1.05
5	2.0	1.6	1.5	1.25	3.1	.7	1.0	2.1	3.25	2.9	.9	1.0
6	1.45	1.5	1.35	1.25	3.0	.6	.7	1.5	2.65	2.4	.85	1.0
7	1.15	1.35	1.2	1.4	2.95	.6	.75	1.35	2.1	2.5	.8	1.0
8	1.0	1.25	1.15	1.25	2.45	.6	.95	1.15	2.1	2.0	.8	1.0
9	1.0	1.2	1.25	1.2	1.9	.5	.9	1.05	1.9	1.9	.8	.9
10	.85	1.15	1.15	1.4	1.65	.6	1.1	.95	1.5	1.65	.75	.9
11	.7	1.1	1.0	1.5	1.45	.55	.75	.8	1.4	1.5	.75	1.0
12	.9	1.05	.95	1.25	1.3	.5	.6	.75	1.8	1.35	1.1	1.2
13	1.35	1.2	.95	1.15	1.2	1.0	.55	.8	1.35	1.3	.95	1.0
14	1.15	1.3	.9	1.1	1.1	3.5	.5	1.3	1.3	1.25	.8	.95
15	1.7	1.35	1.0	5.0	1.0	1.5	.55	1.9	1.2	1.2	.75	.9
16	1.4	1.45	3.2	2.8	1.0	2.9	1.8	1.65	1.0	1.15	.75	.9
17	1.3	1.3	2.2	2.1	.9	2.0	1.8	2.6	1.0	1.3	.75	.9
18	1.2	1.15	1.75	1.8	.9	1.5	1.85	2.2	1.2	1.5	1.0	1.35
19	1.25	1.1	1.55	1.6	.85	1.2	1.35	1.8	8.2	3.5	9.5	1.35
20	1.2	1.05	1.7	1.45	.8	1.1	1.7	1.65	4.0	3.2	5.6	1.2
21	1.1	1.0	1.7	1.3	.8	1.0	1.9	1.6	2.7	3.0	3.2	1.3
22	1.0	1.25	1.5	1.25	.7	.95	1.5	1.7	2.6	1.9	2.35	1.35
23	15.2	1.5	1.4	1.2	.7	.95	1.5	1.5	2.2	1.75	2.0	1.25
24	4.6	1.3	1.3	1.1	.65	.8	1.3	1.35	1.9	1.65	1.75	1.0
25	3.0	1.2	1.35	1.0	.6	1.9	1.0	1.2	1.5	1.5	1.6	.75
26	2.5	1.2	1.35	1.0	.6	1.5	1.2	1.05	1.5	1.4	1.5	.8
27	2.5	1.3	1.35	.95	.9	1.05	1.8	2.2	1.4	1.3	1.4	1.0
28	2.3	1.2	1.4	.9	1.45	.8	1.1	2.1	2.25	1.2	1.3	4.3
29	2.25	.....	1.4	.9	.95	.7	1.3	2.8	2.55	1.15	1.25	4.0
30	2.3	.....	1.45	.85	.8	.65	1.25	4.1	3.2	1.1	1.2	2.9
31	2.3	.....	2.5	.....	.7	.....	1.1	5.4	.....	1.05	.....	2.3

Rating table for Nolichucky River near Greeneville, Tenn., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.50	940	1.10	1,740	1.60	2,580	2.10	3,540
0.60	1,060	1.20	1,900	1.70	2,760	2.20	3,750
0.70	1,180	1.30	2,060	1.80	2,950	2.30	3,960
0.80	1,310	1.40	2,230	1.90	3,140	2.40	4,180
0.90	1,450	1.50	2,400	2.00	3,340	2.50	4,400
1.00	1,590						

NOTE.—The above table is applicable only for open-channel conditions. It is based on three discharge measurements made during 1906 and on the general form of previous curves. There has been considerable change in the conditions of flow at this station, but the above rating is fairly good. Above gage height 2.3 feet the rating curve is a tangent, the difference being 220 per tenth.

Monthly discharge of Nolichucky River near Greeneville, Tenn., for 1906.

[Drainage area, 1,100 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	32,300	1,000	3,760	3.42	3.94
February	4,070	1,590	2,180	1.98	2.06
March	5,940	1,4[illegible]0	2,360	2.15	2.48
April	9,900	1,380	2,460	2.24	2.50
May	5,720	1,060	2,110	1.92	2.21
June	6,600	940	1,840	1.67	1.86
July	3,140	940	1,820	1.65	1.90
August	10,800	1,240	3,070	2.79	3.22
September	16,900	1,590	4,020	3.65	4.07
October	8,580	1,660	3,370	3.06	3.53
November	19,800	1,240	2,850	2.59	2.89
December	8,360	1,240	2,270	2.06	2.38
The year	32,300	940	2,680	2.43	33.04

NOTE.—Values for 1906 are good.

SOUTH FORK OF HOLSTON RIVER AT BLUFF CITY, TENN.

This station, originally established by the United States Weather Bureau, is located at the highway bridge at Bluff City, Tenn. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 115, where are given also references to publications that contain data for previous years.

Discharge measurements of South Fork of Holston River at Bluff City, Tenn., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 26	O. P. Hall	170	437	0.85	666
October 24	F. A. Murray	248	778	2.39	1,760
October 24	do	248	683	2.13	1,440

Daily gage height, in feet, of South Fork of Holston River at Bluff City, Tenn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.0	2.6	1.1	2.5	1.1	0.7	0.6	2.3	2.5	1.0	1.2	1.4
2	.9	2.3	1.1	2.1	1.2	.7	.6	2.0	1.8	1.0	1.1	1.3
3	.9	2.0	1.1	1.9	1.2	.7	.5	1.9	1.6	1.2	1.0	1.2
4	3.3	1.8	1.5	1.8	1.9	.6	.9	1.7	2.8	1.2	1.0	1.2
5	3.2	1.8	1.4	1.6	2.7	.6	.9	2.4	3.2	1.7	1.0	1.2
6	2.4	1.7	1.3	1.6	3.6	.7	.8	2.1	2.3	1.6	1.0	1.1
7	1.9	1.6	1.3	2.6	3.8	.5	.6	1.8	2.3	2.0	.9	1.2
8	1.7	1.6	1.2	2.3	3.2	.5	.5	1.5	2.0	2.1	.9	1.2
9	1.5	1.4	1.2	2.1	2.6	.5	.6	1.4	1.6	1.7	.9	1.1
10	1.2	1.4	1.2	2.2	2.2	.5	.6	1.5	1.5	1.5	.9	1.1
11	1.2	1.2	1.1	2.0	2.0	1.1	.6	1.9	1.3	1.3	1.1	1.2
12	1.3	1.2	1.0	1.8	1.7	.9	.5	1.5	2.4	1.2	2.4	1.3
13	1.7	1.2	1.0	1.7	1.7	.7	.5	2.2	1.7	1.0	2.0	1.2
14	2.2	1.2	1.0	1.6	1.6	.7	.4	2.3	1.3	1.0	1.7	1.2
15	2.7	1.3	1.5	4.0	1.4	.7	.4	3.4	1.2	.9	1.4	1.1
16	2.5	1.3	3.5	4.0	1.4	.8	.6	2.5	1.0	.8	1.4	1.1
17	2.3	1.2	2.9	3.0	1.2	1.1	.7	3.0	.9	.9	1.3	1.1
18	2.1	1.2	2.3	2.6	1.3	1.2	1.3	2.4	.9	.8	1.4	2.7
19	2.1	1.2	2.0	2.1	1.3	1.0	1.2	1.9	.9	1.3	4.8	2.4
20	1.9	1.1	2.4	1.9	1.4	1.4	.9	1.5	.8	6.0	5.8	2.2
21	1.8	1.1	2.5	1.7	1.2	1.6	1.1	1.8	.8	4.0	3.7	2.0
22	1.7	1.4	2.3	1.6	1.1	1.3	1.6	2.1	1.0	3.0	3.0	2.0
23	10.0	1.5	2.0	1.6	1.0	1.0	1.9	1.7	1.5	2.5	2.6	1.9
24	5.6	1.4	1.8	1.6	.9	.8	1.6	1.9	2.0	2.2	2.2	1.6
25	3.8	1.3	1.8	1.4	.9	1.1	1.3	1.9	1.5	1.9	1.9	1.7
26	3.1	1.3	1.6	1.4	.8	1.8	1.2	1.5	1.3	1.7	1.7	1.7
27	2.7	1.3	1.7	1.3	.9	1.5	1.5	1.3	1.0	1.6	1.6	1.7
28	2.9	1.3	1.9	1.2	.9	1.1	1.6	1.3	1.0	1.5	1.6	3.0
29	2.8	.....	2.0	1.2	1.0	.9	1.3	1.2	.9	1.5	1.5	5.5
30	2.7	.....	1.9	1.2	.9	.8	3.0	2.0	1.0	1.3	1.4	4.3
31	2.6	.....	2.1	.....	.8	.....	3.0	2.9	.....	1.2	.....	3.3

Rating table for South Fork of Holston River at Bluff City, Tenn., for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.20	235	1.40	870	2.60	2,070	3.80	3,800
0.30	265	1.50	950	2.70	2,190	3.90	3,980
0.40	300	1.60	1,030	2.80	2,310	4.00	4,160
0.50	340	1.70	1,120	2.90	2,430	4.20	4,530
0.60	385	1.80	1,210	3.00	2,550	4.40	4,910
0.70	435	1.90	1,310	3.10	2,680	4.60	5,310
0.80	485	2.00	1,410	3.20	2,820	4.80	5,730
0.90	540	2.10	1,510	3.30	2,970	5.00	6,180
1.00	600	2.20	1,620	3.40	3,120	5.20	6,650
1.10	665	2.30	1,730	3.50	3,280	5.40	7,130
1.20	730	2.40	1,840	3.60	3,450	5.60	7,630
1.30	800	2.50	1,950	3.70	3,620	5.80	8,130

NOTE.—The above table is based on discharge measurements made during 1904–1906. It is well defined between gage heights 0.5 foot and 3.5 feet. Above gage height 5.4 feet the rating curve is a tangent, the difference being 250 per tenth.

Monthly discharge of South Fork of Holston River at Bluff City, Tenn., for 1906.

[Drainage area, 828 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	18,600	540	2,390	2.89	3.33
February	2,070	665	946	1.14	1.19
March	3,280	600	1,190	1.44	1.66
April	4,160	730	1,480	1.79	2.00
May	3,800	485	1,140	1.38	1.59
June	1,210	340	572	.691	.77
July	2,550	300	715	.864	1.00
August	3,120	730	1,410	1.70	1.96
September	2,820	485	1,060	1.28	1.43
October	3,630	485	1,330	1.61	1.86
November	8,130	540	1,480	1.79	2.00
December	7,380	665	1,420	1.71	1.97
The year	18,600	300	1,260	1.52	20.76

NOTE.—Values for 1906 are good.

HOLSTON RIVER AT AUSTINS MILLS, TENNESSEE.

This station is maintained in cooperation with the United States Weather Bureau, by which the gage readings are furnished. It is located at the Southern Railway bridge at Austins Mills, near Rogersville, Tenn. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 117, where are given also references to publications that contain data for previous years.

The following discharge measurement was made October 25, 1906:

Width, 386 feet; area, 1,980 square feet; gage height, 2.98 feet; discharge, 4,600 second-feet.

Daily gage height, in feet, of Holston River at Austins Mills, Tennessee, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.1	4.0	2.4	3.4	2.3	1.9	2.0	4.8	4.5	2.9	2.1	2.5
2	2.0	3.8	2.3	3.4	2.3	1.9	1.9	3.9	3.8	2.6	2.0	2.4
3	1.9	3.5	2.3	3.2	2.3	1.9	1.7	3.7	3.1	2.6	2.0	2.4
4	3.3	3.1	2.4	3.0	2.7	1.9	1.7	3.4	3.1	2.9	1.9	2.3
5	4.6	3.0	2.8	2.8	3.8	1.9	1.8	3.3	3.8	3.2	1.9	2.3
6	3.8	3.0	2.7	2.8	4.1	1.9	1.8	3.1	5.6	3.7	1.9	2.3
7	3.2	2.9	2.5	3.1	5.4	2.2	1.8	2.8	4.2	3.6	1.8	2.3
8	2.7	2.7	2.4	3.4	5.2	2.1	1.8	2.6	4.1	3.6	1.8	2.4
9	2.6	2.6	2.4	3.2	4.2	2.0	1.8	2.5	3.4	3.2	1.7	2.3
10	2.5	2.4	2.4	3.9	3.5	2.0	1.8	2.6	3.1	2.8	1.7	2.2
11	2.3	2.4	2.3	3.6	3.3	1.9	2.0	2.5	2.8	2.6	1.8	2.2
12	2.5	2.3	2.3	3.2	3.2	1.8	1.8	2.6	2.7	2.4	2.6	2.4
13	2.6	2.2	2.2	3.0	2.9	2.0	1.7	2.5	2.9	2.3	3.2	2.4
14	3.2	2.2	2.2	2.8	2.8	1.9	1.7	3.0	2.6	2.2	2.8	2.3
15	3.7	2.3	3.2	2.9	2.6	2.6	1.7	3.2	2.4	2.2	2.5	2.3
16	3.9	2.2	4.5	5.8	2.5	2.3	1.7	4.3	2.3	2.1	2.4	2.2
17	3.7	2.4	4.6	4.7	2.5	2.5	2.5	3.5	2.2	2.0	2.3	2.2
18	3.3	2.3	3.8	3.9	2.4	2.4	2.8	4.2	2.0	2.0	2.3	2.8
19	3.2	2.3	3.4	3.4	2.4	2.4	2.9	3.4	2.0	2.1	7.2	3.6
20	3.1	2.2	3.2	3.0	2.4	2.4	2.4	3.3	3.6	6.7	11.5	3.3
21	2.9	2.2	3.4	2.8	2.4	2.4	2.2	3.1	2.9	6.3	7.2	3.2
22	2.7	2.2	3.3	2.8	2.3	2.4	2.4	3.2	2.8	4.5	5.0	3.2
23	3.9	2.7	3.1	2.7	2.3	2.3	2.9	3.5	2.9	3.8	4.2	3.1
24	15.0	2.7	3.0	2.6	2.4	2.1	2.8	3.9	2.8	3.3	3.6	3.0
25	6.2	2.5	2.9	2.5	2.1	2.1	2.5	3.8	3.0	3.0	3.3	2.8
26	4.6	2.5	2.8	2.4	2.0	2.4	2.4	3.1	2.6	2.8	3.0	2.4
27	4.3	2.5	3.0	2.4	2.0	2.7	2.4	2.8	2.4	2.7	3.0	2.5
28	4.6	2.4	3.1	2.3	2.0	2.3	3.1	2.9	2.3	2.4	2.9	3.3
29	4.5	.....	3.2	2.3	2.2	2.1	2.6	3.8	2.3	2.4	2.8	6.8
30	4.1	.....	3.2	2.4	2.2	2.0	5.2	5.1	3.5	2.3	2.6	6.8
31	4.0	.....	3.1	.....	2.0	.....	6.2	4.4	.....	2.2	.....	5.4

Rating table for Holston River at Austins Mills, Tennessee, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.70	1,700	2.60	3,660	3.50	6,100	4.40	9,120
1.80	1,900	2.70	3,900	3.60	6,410	4.50	9,490
1.90	2,100	2.80	4,150	3.70	6,720	4.60	9,860
2.00	2,310	2.90	4,410	3.80	7,040	4.70	10,240
2.10	2,520	3.00	4,670	3.90	7,370	4.80	10,620
2.20	2,740	3.10	4,940	4.00	7,710	4.90	11,010
2.30	2,960	3.20	5,220	4.10	8,050	5.00	11,400
2.40	3,190	3.30	5,510	4.20	8,400	5.20	12,200
2.50	3,420	3.40	5,800	4.30	8,760	5.40	13,000

NOTE.—The above table is applicable only for open-channel conditions. It is based on 7 discharge measurements made during 1904 to 1906. It is well defined between gage heights 1.0 foot and 6.0 feet. Above gage height 5.0 feet the rating curve is a tangent, the difference being 400 per tenth.

Monthly discharge of Holston River at Austins Mills, Tennessee, for 1906.

[Drainage area, 3,060 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	51,400	2,100	7,550	2.47	2.85
February	7,710	2,740	3,790	1.24	1.29
March	9,860	2,740	4,580	1.50	1.73
April	14,600	2,960	5,180	1.69	1.89
May	13,000	2,310	4,400	1.44	1.66
June	3,900	1,900	2,660	.869	.97
July	16,200	1,700	3,440	1.12	1.29
August	11,800	3,420	5,900	1.93	2.22
September	13,800	2,310	5,040	1.65	1.84
October	18,200	2,310	5,060	1.65	1.90
November	37,400	1,700	5,970	1.95	2.18
December	18,600	2,740	4,960	1.62	1.87
The year	51,400	1,700	4,880	1.59	21.69

NOTE.—Values for 1906 are excellent.

WATAUGA RIVER NEAR ELIZABETHTON, TENN.

This station was established May 11, 1903. It is located on the Virginia and Southwestern Railway bridge at Siam, about 4 miles from Elizabethton, Tenn. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 119, where are given also references to publications that contain data for previous years.

The following discharge measurement was made October 22, 1906:

Width, 213 feet; area, 1,080 square feet; gage height, 3.17 feet; discharge, 1,970 second-feet.

Dailg gage height, in feet, of Watauga River near Elizabethton, Tenn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.65	2.6	1.85	2.8	1.7	1.5	1.7	2.4	4.1	4.2	1.8	1.7
2	1.6	2.5	1.8	2.7	1.7	1.5	1.65	2.6	3.0	4.2	1.75	1.7
3	1.6	2.3	1.8	2.6	1.7	1.5	1.6	2.5	2.7	4.5	1.7	1.8
4	3.6	2.2	2.6	2.1	2.0	1.5	1.6	2.4	3.0	4.3	1.7	1.8
5	2.8	2.1	2.6	2.0	3.0	1.45	1.55	2.35	4.0	3.2	1.7	1.75
6	2.6	2.0	2.5	2.2	3.5	1.45	1.55	2.3	3.9	2.9	1.7	1.8
7	2.4	2.0	2.4	2.2	3.4	1.4	1.5	2.0	3.7	2.7	1.65	1.8
8	2.3	2.0	2.8	2.0	3.0	1.45	1.5	1.8	3.5	2.4	1.65	1.6
9	2.0	2.0	2.6	2.0	2.9	1.45	2.2	1.7	3.4	2.2	1.6	1.6
10	1.7	2.0	2.5	1.9	2.7	1.4	1.7	1.65	3.2	2.1	1.6	1.6
11	1.7	1.95	1.9	1.9	2.5	1.4	1.5	1.6	3.0	2.0	1.75	1.6
12	1.8	1.95	1.7	1.85	2.0	3.0	1.5	1.6	2.8	1.9	2.0	1.6
13	2.0	1.9	1.7	1.8	1.9	3.5	1.45	1.8	2.4	1.9	2.0	1.6
14	2.9	1.9	1.7	1.8	1.85	3.0	1.4	2.0	2.2	1.9	1.9	1.6
15	2.6	2.1	2.6	5.0	1.8	2.8	3.0	2.3	1.9	1.9	1.75	1.6
16	2.6	2.0	3.0	3.6	1.8	2.7	2.6	2.6	1.85	1.8	1.65	1.6
17	2.5	1.9	2.4	3.4	1.7	2.7	2.4	4.2	1.8	1.8	1.6	1.65
18	2.4	1.8	2.4	3.0	1.65	2.6	2.0	2.7	1.7	1.9	2.0	2.1
19	2.2	1.8	2.3	2.5	1.6	2.4	1.8	2.6	5.0	6.0	7.0	2.0
20	2.2	1.9	2.3	2.4	1.6	2.3	2.0	2.3	4.2	5.6	4.6	2.0
21	2.1	2.4	2.2	2.2	1.55	2.0	2.3	2.3	2.7	4.0	3.4	1.9
22	7.3	2.4	2.3	2.15	1.5	1.7	2.2	2.3	3.1	3.15	2.9	1.85
23	7.4	2.1	2.4	2.1	1.5	1.65	2.0	2.3	3.0	2.7	2.6	1.8
24	4.8	2.1	2.4	2.1	1.5	2.4	1.9	2.2	2.8	2.6	2.5	1.8
25	3.6	2.0	2.35	2.0	1.45	2.55	1.85	2.2	2.5	2.4	2.4	1.8
26	3.1	2.0	2.2	1.9	1.4	2.2	1.8	2.4	2.3	2.3	2.3	1.85
27	2.9	1.9	2.1	1.8	1.8	2.0	2.9	2.6	2.15	2.2	2.15	1.9
28	2.9	1.9	2.0	1.8	1.9	1.9	2.3	4.5	2.15	2.0	2.0	3.2
29	2.8	.....	2.0	1.8	1.7	1.8	2.2	6.8	4.7	1.9	1.9	4.4
30	2.8	.....	3.4	1.75	1.6	1.7	2.1	5.4	4.3	1.85	1.7	3.9
31	2.7	.....	2.9	.....	1.55	.....	2.4	5.3	.....	1.8	.....	3.6

Rating table for Watauga River near Elizabethton, Tenn., for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	205	2.40	1,010	3.00	2,330	5.60	5,200
1.30	250	2.50	1,100	3.70	2,460	5.80	5,520
1.40	300	2.60	1,190	3.80	2,590	6.00	5,840
1.50	355	2.70	1,285	3.90	2,720	6.20	6,180
1.60	410	2.80	1,385	4.00	2,850	6.40	6,520
1.70	470	2.90	1,490	4.20	3,110	6.60	6,860
1.80	535	3.00	1,600	4.40	3,390	6.80	7,200
1.90	605	3.10	1,710	4.60	3,670	7.00	7,540
2.00	680	3.20	1,825	4.80	3,970	8.00	9,340
2.10	755	3.30	1,945	5.00	4,270	9.00	11,240
2.20	835	3.40	2,070	5.20	4,570		
2.30	920	3.50	2,200	5.40	4,880		

NOTE.—The above table is based on discharge measurements made during 1904–6. It is well defined between gage heights 1.4 feet and 3.7 feet.

Monthly discharge of Watauga River near Elizabethton, Tenn., for 1906.

[Drainage area, 408 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	8,260	410	1,640	4.02	4.64
February	1,190	535	732	1.79	1.86
March	2,070	470	959	2.35	2.71
April	4,270	502	1,000	2.45	2.73
May	2,200	300	728	1.78	2.05
June	2,200	300	765	1.87	2.09
July	1,600	300	668	1.64	1.89
August	7,200	410	1,300	3.19	3.68
September	4,270	470	1,750	4.29	4.79
October	5,840	535	1,560	3.82	4.40
November	7,540	410	1,020	2.50	2.79
December	3,390	410	776	1.90	2.19
The year	8,260	300	1,070	2.63	35.82

NOTE.—As values for 1906 are based on the only measurement made during the year they should be rated as fair, but it is probable that good would be a better rating.

LITTLE TENNESSEE RIVER AT JUDSON, N. C.

This station was established in June, 1896. It is located on the Southern Railway bridge about one-fourth mile from Judson, N. C. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 122, where are given also references to publications that contain data for previous years.

Discharge measurements of Little Tennessee River at Judson, N. C., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 10	O. P. Hall	147	445	3.82	1,860
April 13	do	155	508	4.18	2,630
June 9	do	144	378	3.30	1,480
November 5	do	152	433	3.72	1,820
November 6	do	152	424	3.70	1,810

Daily gage height, in feet, of Little Tennessee River at Judson, N. C., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.75	4.5	3.7	5.1	4.0	4.6	3.4	4.7	5.1	9.4	3.85	4.15
2	3.3	4.4	3.6	4.8	4.1	4.6	3.3	4.75	5.2	7.6	3.8	4.1
3	3.55	4.2	3.75	4.55	4.1	3.65	3.3	4.45	4.1	8.0	3.8	4.05
4	4.3	4.2	3.75	4.4	4.1	3.6	4.6	5.0	4.15	8.0	3.8	4.0
5	8.0	4.2	4.2	4.3	4.1	3.65	3.9	4.5	4.25	7.0	3.75	3.9
6	6.0	4.1	3.95	4.25	3.75	3.9	4.6	4.95	4.4	7.9	3.7	4.0
7	4.7	4.0	3.8	4.15	3.2	3.5	3.95	4.55	4.4	6.9	3.65	4.2
8	4.5	4.0	3.95	4.15	3.85	3.4	3.95	4.25	4.5	6.0	3.6	[illegible]
9	4.6	3.9	3.9	4.0	3.75	3.3	3.8	4.0	4.25	5.7	3.6	3.9
10	4.25	3.8	3.8	5.0	3.65	3.2	3.8	4.0	4.0	5.5	3.6	3.9
11	4.1	3.8	3.7	4.55	3.2	3.2	3.65	4.0	3.9	5.2	3.8	4.8
12	4.75	3.8	3.6	4.5	3.1	3.4	3.9	4.8	4.5	5.0	3.75	4.3
13	4.4	3.8	3.6	4.2	3.6	3.8	3.8	4.85	3.2	4.9	3.5	4.1
14	4.4	3.8	3.6	4.15	3.5	5.0	6.1	4.85	3.9	4.8	3.55	4.0
15	4.3	3.7	4.8	5.0	3.35	5.3	6.3	4.25	3.8	4.7	3.6	3.95
16	4.3	3.6	5.6	5.0	3.4	5.1	6.3	5.5	3.75	4.6	3.5	3.75
17	4.4	3.55	4.6	4.9	3.35	4.6	6.3	4.0	3.6	4.5	3.6	4.1
18	4.4	3.65	4.25	4.65	3.25	4.2	6.8	4.4	3.5	4.45	5.4	5.3
19	4.1	3.65	4.45	4.65	3.3	4.0	5.0	4.5	7.1	5.5	13.5	4.7
20	4.0	3.5	6.0	4.45	3.3	3.9	3.15	4.5	6.6	4.8	7.7	4.7
21	4.0	3.5	5.1	4.15	3.3	3.75	6.2	4.75	5.8	4.6	6.1	4.5
22	4.7	3.9	5.7	4.2	3.25	3.7	5.4	4.1	5.0	4.5	5.5	4.5
23	9.0	3.6	4.45	4.1	3.2	5.5	4.2	4.1	5.0	4.4	5.1	4.2
24	7.0	3.5	4.3	4.0	3.1	4.4	4.85	5.2	4.9	4.3	4.9	4.1
25	5.9	3.6	4.3	4.0	3.15	4.3	4.25	4.4	4.75	4.25	4.7	3.0
26	5.5	3.5	4.25	3.9	3.2	4.2	4.5	4.2	4.7	4.2	4.5	3.1
27	5.4	3.55	4.2	3.85	4.7	3.75	4.5	4.2	4.6	4.1	4.4	3.0
28	5.2	3.6	4.25	4.15	3.8	4.6	4.5	4.3	4.6	4.05	4.3	4.5
29	5.0	.....	4.2	4.0	3.4	3.5	4.0	4.5	7.3	4.0	4.25	4.5
30	4.8	.....	5.1	4.0	3.4	3.5	4.5	6.2	12.0	4.0	4.2	4.5
31	4.65	.....	5.9	.....	3.3	.....	4.5	6.2	.....	3.9	.....	6.0

Rating table for Little Tennessee River at Judson, N. C., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.00	1,000	4.20	2,580	5.40	4,920	7.20	9,670
3.10	1,100	4.30	2,750	5.50	5,150	7.40	10,290
3.20	1,200	4.40	2,920	5.60	5,380	7.60	10,930
3.30	1,310	4.50	3,100	5.70	5,620	7.80	11,600
3.40	1,430	4.60	3,280	5.80	5,860	8.00	12,300
3.50	1,550	4.70	3,470	5.90	6,110	8.20	13,030
3.60	1,680	4.80	3,660	6.00	6,360	8.40	13,800
3.70	1,820	4.90	3,860	6.20	6,870	8.60	14,600
3.80	1,960	5.00	4,060	6.40	7,390	8.80	15,400
3.90	2,110	5.10	4,270	6.60	7,930	9.00	16,200
4.00	2,260	5.20	4,480	6.80	8,490	10.00	20,700
4.10	2,420	5.30	4,700	7.00	9,070	11.00	25,500

NOTE.—The above table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1906 and on the general form of the 1905 curve. It is well defined between gage heights 3.0 feet and 11.0 feet. Above gage height 10.0 feet the rating curve is a tangent, the difference being 480 per tenth.

Monthly discharge of Little Tennessee River at Judson, N. C., for 1906

[Drainage area, 675 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	16,200	1,310	4,080	6.04	6.96
February	3,100	1,550	2,010	2.98	3.10
March	6,360	1,680	2,940	4.36	5.03
April	4,270	2,030	2,900	4.30	4.80
May	3,470	1,100	1,650	2.44	2.81
June	5,150	1,200	2,420	3.59	4.00
July	8,490	1,150	3,450	5.11	5.89
August	6,870	2,200	3,380	5.01	5.78
September	30,300	1,200	4,490	6.65	7.42
October	18,000	2,110	5,380	7.97	9.19
November	37,500	1,550	4,050	6.00	6.69
December	6,360	1,000	2,650	3.93	4.53
The year	37,500	1,000	3,280	4.86	66.20

NOTE.—Values for 1906 are good.

LITTLE TENNESSEE RIVER AT M'GHEE, TENN.

This station was established in 1904 by the United States Weather Bureau. It is located at the Louisville and Nashville Railroad bridge, about one-third mile south of McGhee Station, Tenn. During 1905–6 discharge measurements have been made by the Geological Survey, and gage-height records have been furnished by the Weather Bureau. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 125, where are given also references to publications that contain data for previous years.

Discharge measurements of Little Tennessee River at McGhee, Tenn., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 14	O. P. Hall	464	1,330	3.84	4,910
April 21	do	477	1,730	4.62	7,230
June 14	do	502	2,430	5.74	11,000
November 1	do	458	1,290	3.81	4,770

Daily gage height, in feet, of Little Tennessee River at McGhee, Tenn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.8	4.8	3.7	6.2	4.0	3.3	3.8	4.9	6.1	13.3	3.8	4.7
2	3.7	4.7	3.6	5.6	4.2	4.1	3.6	5.1	5.7	8.5	3.8	4.5
3	4.0	4.5	4.0	5.2	4.1	4.3	3.5	4.9	5.2	9.3	3.8	4.6
4	12.5	4.4	6.7	4.9	4.5	3.7	3.8	5.5	4.6	9.4	3.7	4.6
5	7.6	4.3	5.0	4.7	4.2	3.9	4.4	5.5	5.1	8.0	3.6	4.1
6	6.0	4.3	4.5	4.7	4.1	3.9	3.8	5.0	5.6	7.2	3.6	4.3
7	5.2	4.2	4.2	4.9	4.5	3.8	4.4	5.0	5.3	8.7	3.6	4.9
8	4.8	4.1	4.2	4.5	4.3	3.6	5.0	4.5	5.2	7.1	3.6	4.5
9	5.6	4.0	4.3	4.6	4.0	3.4	5.3	4.3	5.0	6.3	3.6	4.3
10	4.6	3.9	4.2	7.1	3.9	3.3	4.4	4.2	6.0	5.8	3.5	4.3
11	4.4	3.7	4.1	5.6	3.8	3.3	3.9	4.1	5.1	5.5	3.6	4.9
12	4.8	3.7	4.0	5.0	3.7	3.6	4.0	3.9	5.3	5.2	4.0	5.0
13	5.0	3.9	3.9	4.8	3.7	3.7	3.9	3.9	5.1	5.1	3.6	4.6
14	4.8	3.8	3.8	4.6	3.6	5.8	3.6	4.0	4.3	4.9	3.5	4.4
15	4.7	3.8	5.5	7.7	3.5	5.5	8.2	4.8	4.2	4.8	3.5	4.3
16	4.7	3.7	7.5	6.6	3.4	7.6	6.4	4.9	3.3	4.7	3.5	4.3
17	4.5	3.6	5.5	5.6	3.4	5.6	6.0	4.5	3.2	4.5	3.5	4.3
18	4.4	3.6	5.0	5.3	3.4	4.8	9.3	4.4	3.1	4.5	4.3	7.8
19	5.0	3.6	4.8	5.0	3.4	4.9	7.7	4.9	6.7	6.2	22.2	5.9
20	4.6	3.5	7.0	4.8	3.4	4.4	6.5	4.7	7.5	5.1	20.4	5.4
21	4.4	3.5	5.9	4.7	3.4	4.1	6.5	4.9	5.9	4.9	10.0	5.3
22	4.3	4.5	5.3	4.6	3.3	4.0	8.0	4.5	5.5	4.7	8.2	5.2
23	14.0	4.0	5.0	4.4	3.3	3.9	7.7	4.4	5.3	4.5	7.1	4.7
24	9.2	3.8	4.7	4.2	3.2	4.9	6.2	4.3	5.3	4.4	6.5	4.6
25	6.9	3.7	4.8	4.2	3.2	5.5	5.5	5.0	5.0	4.3	5.9	4.1
26	6.2	3.7	4.6	4.1	3.2	5.5	5.0	4.5	4.9	4.2	5.6	3.9
27	6.2	3.7	4.8	4.1	4.0	4.7	5.2	4.5	4.6	4.1	5.4	4.2
28	5.8	4.0	5.0	4.2	4.1	4.4	5.0	5.1	4.7	4.0	5.2	4.9
29	5.5	.....	4.8	4.4	4.1	4.1	4.5	4.8	5.0	4.0	5.0	7.7
30	5.2	.....	5.8	4.1	3.7	4.0	5.2	5.7	8.9	3.9	4.8	6.3
31	5.0	.....	7.6	.....	3.5	.....	5.0	7.2	.....	3.9	.....	6.5

Rating table for Little Tennessee River at McGhee, Tenn., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.10	3,200	4.40	6,500	5.70	10,320	8.00	17,520
3.20	3,420	4.50	6,780	5.80	10,620	8.20	18,180
3.30	3,650	4.60	7,060	5.90	10,920	8.40	18,840
3.40	3,890	4.70	7,350	6.00	11,220	8.60	19,500
3.50	4,130	4.80	7,640	6.20	11,840	8.80	20,160
3.60	4,380	4.90	7,930	6.40	12,460	9.00	20,820
3.70	4,630	5.00	8,220	6.60	13,080	10.00	24,220
3.80	4,890	5.10	8,520	6.80	13,700	11.00	27,720
3.90	5,150	5.20	8,820	7.00	14,320	12.00	31,320
4.00	5,410	5.30	9,120	7.20	14,960	13.00	35,020
4.10	5,680	5.40	9,420	7.40	15,600	14.00	38,820
4.20	5,950	5.50	9,720	7.60	16,240	15.00	42,620
4.30	6,220	5.60	10,020	7.80	16,880		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 11 discharge measurements made during 1903 to 1906 and one made in 1901. It is well defined between gage heights 2.2 feet and 5.0 feet. Above gage height 13.0 feet the rating curve is a tangent, the difference being 380 per tenth.

Monthly discharge of Little Tennessee River at McGhee, Tenn., for 1906.

[Drainage area, 2,470 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec. ft. per sq. mile.	Depth in inches.
January	38,800	4,630	10,600	4.29	4.95
February	7,640	4,130	5,340	2.16	2.25
March	16,200	4,380	8,200	3.32	3.83
April	16,600	5,680	8,320	3.37	3.76
May	6,780	3,420	4,780	1.94	2.24
June	16,200	3,650	6,570	2.66	2.97
July	21,800	4,130	9,380	3.80	4.38
August	15,000	5,150	7,590	3.07	3.54
September	20,500	3,200	9,010	3.65	4.07
October	36,200	5,150	11,000	4.45	5.13
November	70,000	4,130	11,300	4.57	5.10
December	16,900	5,150	8,140	3.30	3.80
The year	70,000	3,200	8,350	3.38	46.02

NOTE.—Values for 1906 are excellent.

TUCKASEGEE RIVER AT BRYSON, N. C.

This station was originally established in June, 1896, at the Southern Railway bridge about 3 miles above Bryson, N. C., just below Governor Island post-office, but was abandoned March 25, 1897, on account of the poor section. The present station was established November 7, 1897, at the highway bridge in the town of Bryson, N. C. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 128, where are given also references to publications that contain data for previous years.

Discharge measurements of Tuckasegee River at Bryson, N. C., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 10	O. P. Hall	190	951	1.78	1,370
April 17	do	190	1,130	2.67	2,830
June 9	do	190	888	1.63	1,180
November 6	do	190	866	1.68	1,230

Daily gage height, in feet, of Tuckasegee River at Bryson, N. C., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.6	2.2	1.6	2.7	2.0	1.55	1.65	2.2	2.5	3.8	1.75	1.95
2	1.6	2.15	1.6	2.45	1.9	2.5	1.6	2.4	2.25	4.8	1.75	1.9
3	5.5	2.0	3.6	2.3	2.1	1.5	2.0	2.3	2.4	4.6	1.7	2.0
4	3.6	1.95	2.3	2.2	2.0	1.7	2.1	2.2	2.4	3.9	1.7	1.9
5	2.9	2.0	2.0	2.15	1.9	1.9	1.8	2.0	3.2	3.5	1.7	1.85
6	2.5	1.95	1.9	2.3	2.0	1.9	2.1	2.1	2.6	4.2	1.7	2.3
7	2.3	1.9	1.85	2.1	2.0	1.7	1.9	2.0	2.4	3.4	1.65	1.9
8	2.2	1.85	2.0	2.05	1.9	1.6	2.0	1.9	2.2	3.1	1.65	1.8
9	2.05	1.8	1.9	2.5	1.8	1.6	1.9	1.7	2.1	2.9	1.6	1.8
10	1.9	1.8	1.8	2.4	1.7	1.7	1.65	1.7	2.0	2.7	1.6	2.2
11	1.9	1.75	1.75	2.25	1.7	1.7	1.65	1.7	1.9	2.5	1.9	2.3
12	2.1	1.85	1.7	2.15	1.7	1.65	1.6	1.65	2.0	2.4	1.7	2.0
13	2.0	1.8	1.7	2.1	1.7	3.7	1.6	1.6	2.0	2.45	1.7	1.9
14	2.1	1.8	1.9	3.75	1.65	2.2	2.4	1.9	1.8	2.3	1.7	1.9
15	2.0	1.75	3.45	3.3	1.6	3.6	2.6	2.2	1.8	2.2	1.6	1.9
16	2.1	1.7	2.5	2.8	1.6	2.5	2.2	2.0	1.75	2.2	1.6	1.9
17	1.9	1.65	2.2	2.6	1.6	2.2	2.7	2.0	1.7	2.15	1.75	3.0
18	2.3	1.65	2.1	2.4	1.55	2.0	3.35	2.4	4.2	3.0	5.0	2.6
19	2.0	1.65	2.5	2.3	1.55	2.0	2.7	2.1	4.6	2.4	10.0	2.3
20	2.0	1.6	2.7	2.2	1.5	1.9	2.4	2.0	3.1	2.35	4.2	2.3
21	2.0	2.0	2.4	2.2	1.5	1.8	2.5	2.1	2.7	2.2	3.4	2.3
22	4.3	1.8	2.3	2.1	1.55	1.8	2.7	2.0	2.6	2.1	2.9	2.2
23	5.0	1.7	2.15	2.0	1.5	1.75	2.5	2.0	2.8	2.0	2.8	2.2
24	3.4	1.7	2.2	2.0	1.45	2.6	2.5	2.3	2.5	2.0	2.5	2.0
25	3.0	1.65	2.1	1.95	1.4	2.2	2.2	2.0	2.4	1.9	2.4	2.05
26	3.1	1.6	2.0	1.9	1.5	1.9	2.1	2.0	2.25	1.9	2.25	2.0
27	2.75	1.85	2.4	1.9	2.0	1.9	2.0	2.1	2.3	1.85	2.2	2.0
28	2.6	1.6	2.2	1.9	2.4	1.8	2.0	2.3	2.4	1.8	2.1	2.9
29	2.5	.....	2.5	1.9	1.9	1.8	2.1	2.7	4.4	1.8	2.0	2.6
30	2.4	.....	4.2	1.85	1.7	1.7	2.1	3.6	6.2	1.8	2.0	2.55
31	2.3	.....	3.0	.....	1.6	.....	2.0	2.8	.....	1.8	.....	4.0

Rating table for Tuckasegee River at Bryson, N. C., 1904 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	380	2.00	1,660	3.10	3,670	4.40	6,920
1.00	460	2.10	1,810	3.20	3,890	4.60	7,530
1.10	550	2.20	1,970	3.30	4,110	4.80	8,160
1.20	650	2.30	2,130	3.40	4,330	5.00	8,800
1.30	750	2.40	2,300	3.50	4,560	5.20	9,475
1.40	860	2.50	2,480	3.60	4,800	5.40	10,250
1.50	980	2.60	2,660	3.70	5,040	5.60	11,125
1.60	1,100	2.70	2,850	3.80	5,290	5.80	12,100
1.70	1,230	2.80	3,050	3.90	5,540	6.00	13,200
1.80	1,370	2.90	3,250	4.00	5,800	6.20	14,360
1.90	1,510	3.00	3,460	4.20	6,350	6.40	15,520

NOTE.—The above table is based on discharge measurements made during 1904 to 1906. It is well defined to gage height 3 feet. Above gage height 6.0 feet the rating curve is a tangent, the difference being 580 per tenth.

Monthly discharge of Tuckasegee River at Bryson, N. C., for 1906.

[Drainage area, 662 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	10,700	1,100	2,870	4.34	5.00
February	1,970	1,100	1,390	2.10	2.19
March	6,350	1,100	2,190	3.31	3.82
April	5,160	1,440	2,170	3.28	3.66
May	2,300	860	1,300	1.96	2.26
June	5,040	980	1,750	2.64	2.94
July	4,220	1,100	1,930	2.92	3.37
August	4,800	1,100	1,900	2.87	3.31
September	14,400	1,230	3,070	4.64	5.18
October	8,160	1,370	2,960	4.47	5.15
November	36,400	1,100	3,230	4.88	5.44
December	5,800	1,370	2,040	3.08	3.55
The year	36,400	860	2,230	3.37	45.87

NOTE.--Values for 1906 are excellent.

HIWASSEE RIVER AT MURPHY, N. C.

This station was established July 26, 1896. It is located at the highway bridge, Murphy, N. C., about 80 feet above the Louisville and Nashville Railroad bridge and one-half mile above the mouth of Valley River. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 130, where are given also references to publications that contain data for previous years.

Discharge measurements of Hiwassee River at Murphy, N. C., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 9	O. P. Hall	169	425	5.78	902
April 11	do	172	473	6.17	1,310
April 11	M. R. Hall	172	471	6.17	1,400
April 16	do	176	559	6.68	2,060
June 7	O. P. Hall	170	426	5.61	847
November 7	do	170	414	5.63	799

Daily gage height, in feet, of Hiwassee River at Murphy, N. C., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.6	6.1	5.5	6.7	5.75	5.4	5.4	6.4	6.65	9.0	5.7	6.0
2	5.6	6.05	5.5	6.45	5.75	6.7	5.4	6.4	6.3	7.6	5.7	6.0
3	5.85	5.95	5.65	6.25	5.75	5.65	5.4	6.2	6.15	7.8	5.7	6.0
4	8.2	5.9	6.15	6.15	5.85	5.8	5.65	6.3	6.1	7.8	5.65	5.95
5	6.9	5.9	5.9	6.1	5.75	5.85	5.4	6.1	6.1	7.2	5.65	5.9
6	6.45	5.85	5.75	6.05	5.7	5.8	5.4	6.0	5.95	7.4	5.65	5.9
7	6.25	5.85	5.7	6.0	6.15	5.6	5.5	6.25	5.9	7.2	5.65	[illegible]
8	6.1	5.8	5.9	5.95	5.85	5.5	5.35	5.9	6.4	6.85	5.6	5.95
9	6.05	5.8	5.8	5.95	5.7	5.5	5.75	5.8	5.85	6.6	5.6	5.9
10	6.2	5.75	5.75	6.55	5.7	5.4	5.4	5.7	5.85	6.5	5.6	5.9
11	5.9	5.7	5.7	6.25	5.65	5.4	5.4	5.65	5.75	6.35	5.6	[illegible]
12	6.3	5.7	5.65	6.1	5.65	5.55	5.45	5.6	6.7	6.25	5.75	[illegible]
13	6.05	5.7	5.65	6.05	5.65	5.75	5.4	5.6	5.9	6.15	5.6	[illegible]
14	6.05	5.65	5.65	6.0	5.6	6.2	5.35	6.3	5.7	6.1	5.6	[illegible]
15	5.95	5.65	7.6	7.4	5.55	6.15	6.9	7.4	5.7	6.05	5.55	[illegible]
16	5.95	5.65	6.95	6.75	5.5	6.55	6.45	6.25	5.65	6.0	5.6	[illegible]
17	5.85	5.6	6.4	6.45	5.5	6.1	8.2	5.9	5.6	6.0	5.65	[illegible]
18	5.95	5.6	6.2	6.25	5.5	5.85	6.45	5.95	5.05	5.95	6.6	[illegible]
19	5.95	5.55	6.2	6.15	5.45	5.75	5.95	6.0	7.0	6.5	15.8	[illegible]
20	5.85	5.55	7.2	6.05	5.45	5.7	6.4	6.25	6.35	6.2	8.2	[illegible]
21	5.85	5.65	6.65	6.0	5.4	5.55	6.45	6.1	6.25	6.1	7.2	[illegible]
22	5.95	5.7	6.4	5.95	5.45	5.1	6.3	6.2	6.3	6.05	6.95	[illegible]
23	9.5	5.6	6.25	5.9	5.4	5.45	6.2	5.95	6.25	6.0	6.6	[illegible]
24	7.5	5.6	6.1	5.85	5.35	6.2	6.05	6.1	6.3	5.95	6.45	[illegible]
25	6.6	5.6	6.1	5.8	5.35	5.95	5.85	6.0	6.15	5.9	6.3	[illegible]
26	6.7	5.55	6.1	5.8	5.45	6.0	6.05	5.8	6.1	5.85	6.25	[illegible]
27	6.65	5.55	6.1	5.8	6.25	5.65	5.85	6.05	6.05	5.8	6.2	[illegible]
28	6.25	5.5	6.05	6.85	5.65	5.55	5.75	5.8	5.95	5.75	6.15	[illegible]
29	6.35	.....	6.05	5.9	5.55	5.6	5.7	6.4	7.1	5.75	6.1	[illegible]
30	6.25	.....	6.5	5.85	5.45	5.5	6.3	8.7	9.6	5.75	6.05	[illegible]
31	6.2	.....	7.2	.....	5.4	.....	5.85	7.4	.....	5.75	.....	[illegible]

Rating table for Hiwassee River at Murphy, N. C., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.00	310	5.90	1,010	6.80	2,370	7.70	4,180
5.10	365	6.00	1,130	6.90	2,550	7.80	4,400
5.20	425	6.10	1,260	7.00	2,740	7.90	4,620
5.30	490	6.20	1,400	7.10	2,930	8.00	4,840
5.40	560	6.30	1,540	7.20	3,130	8.20	5,280
5.50	635	6.40	1,690	7.30	3,330	8.40	5,720
5.60	715	6.50	1,850	7.40	3,540		
5.70	800	6.60	2,020	7.50	3,750		
5.80	900	6.70	2,190	7.60	3,960		

NOTE.—The above table is applicable only for open-channel conditions. It is based on dis[illegible] measurements made during 1900 to 1906. It is well defined between gage heights 5.0 feet and [illegible] Above gage height 8.0 feet the rating curve is a tangent, the difference being 2.0 per tenth.

Monthly discharge of Hiwassee River at Murphy, N. C., for 1906.

[Drainage area, 410 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	8,140	715	1,760	4.29	4.95
February	1,260	635	830	2.02	2.10
March	3,960	635	1,410	3.44	3.97
April	3,540	900	1,410	3.44	3.84
May	1,470	525	749	1.83	2.11
June	2,190	365	912	2.22	2.48
July	5,280	560	1,150	2.80	3.23
August	6,380	715	1,520	3.71	4.28
September	8,360	338	1,570	3.83	4.27
October	7,040	850	1,950	4.76	5.49
November	22,000	715	1,990	4.85	5.41
December	4,400	1,010	1,630	3.98	4.59
The year	22,000	338	1,410	3.43	46.72

NOTE.—Values for 1906 are excellent.

HIWASSEE RIVER AT RELIANCE, TENN.

This station was established August 17, 1900. It is located at the Louisville and Nashville Railroad bridge at Reliance, Tenn. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 132, where are given also references to publications that contain data for previous years.

Discharge measurements of Hiwassee River at Reliance, Tenn., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 13	O. P. Hall	317	1,990	1.88	2,090
April 20	do	326	2,210	2.27	3,000
June 13	do	330	2,270	2.38	3,440
November 2	do	319	2,040	1.92	2,240

Daily gage height, in feet, of Hiwassee River at Reliance, Tenn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.85	2.35	1.7	3.1	2.05	1.5	1.7	2.9	3.0	5.4	1.95	2.3
2	1.8	2.25	1.7	2.25	2.0	1.75	1.6	3.1	2.6	3.9	1.95	2.25
3	1.95	2.2	2.1	2.5	1.95	2.0	1.6	2.85	2.4	4.5	1.9	2.25
4	6.3	2.1	2.8	2.4	2.1	1.8	1.75	2.75	2.35	4.2	1.9	2.25
5	3.6	2.05	2.3	2.3	2.0	1.9	1.75	2.5	2.25	4.2	1.9	2.3
6	2.9	2.05	2.1	2.2	1.95	2.15	1.6	2.3	2.65	3.4	1.9	2.1
7	2.5	2.0	2.0	2.15	2.0	1.9	1.55	2.7	2.25	4.0	1.85	2.5
8	2.3	2.0	2.05	2.2	2.05	1.75	1.65	2.3	2.25	3.4	1.85	2.2
9	2.7	1.95	2.15	2.5	1.95	1.65	1.65	2.15	2.25	3.0	1.8	2.15
10	2.35	1.9	2.0	3.4	1.9	1.5	1.75	2.0	2.25	2.8	1.8	2.1
11	2.2	1.85	1.9	2.45	1.85	1.5	1.55	1.95	2.2	2.35	1.85	3.2
12	2.3	1.85	1.85	2.5	1.8	1.5	1.65	1.9	2.65	2.25	2.0	2.3
13	2.35	1.9	1.85	2.3	1.8	2.05	1.65	1.85	2.25	2.0	1.85	2.4
14	2.3	1.85	1.85	2.25	1.75	2.8	2.3	1.85	2.15	2.4	1.8	2.3
15	2.2	1.85	3.0	3.65	1.7	2.5	5.0	2.25	2.0	2.3	1.85	2.25
16	2.2	1.8	3.6	3.1	1.65	3.6	3.2	2.3	1.95	2.3	1.85	2.2
17	2.15	1.75	2.85	2.6	1.65	2.7	2.9	2.0	1.85	2.25	1.9	2.25
18	2.1	1.75	2.45	2.5	1.6	2.3	5.4	2.0	1.85	2.4	2.7	3.9
19	2.35	1.75	2.45	2.4	1.6	2.1	3.7	2.0	3.5	3.4	15.2	3.0
20	2.15	1.7	4.0	2.2	1.55	2.0	3.1	2.35	2.9	2.35	7.0	2.85
21	2.05	1.8	3.2	2.25	1.55	1.9	3.0	2.6	2.5	2.4	4.1	2.75
22	2.4	2.0	2.6	2.2	1.55	1.8	4.1	2.15	2.85	2.3	3.5	2.65
23	6.9	1.85	2.5	2.1	1.55	1.7	3.3	2.3	2.55	2.25	3.1	2.55
24	4.0	1.8	2.4	2.05	1.5	1.75	2.75	2.25	2.85	2.2	2.9	2.4
25	3.2	1.75	2.35	2.0	1.45	2.5	2.5	2.3	2.5	2.2	2.7	2.3
26	2.25	1.75	2.35	2.0	1.6	2.2	2.4	2.25	2.4	2.15	2.6	2.35
27	2.9	1.8	2.2	2.1	2.4	2.0	2.4	2.0	2.25	2.1	2.5	2.2
28	2.7	1.8	2.2	2.2	1.9	1.9	2.1	2.1	2.25	2.0	2.4	2.4
29	2.6	.....	2.3	2.3	1.75	1.85	2.0	2.05	2.25	2.05	2.35	4.2
30	2.5	.....	2.9	2.05	1.65	1.7	2.4	3.8	5.2	2.0	2.3	3.3
31	2.4	.....	3.2	.....	1.55	.....	2.35	3.9	.....	2.0	.....	3.8

Rating table for Hiwassee River at Reliance, Tenn., 1904 to 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.70	380	1.70	1,725	2.60	4,090	3.50	7,300
0.80	460	1.80	1,940	2.70	4,410	3.60	7,690
0.90	550	1.90	2,165	2.80	4,745	3.70	8,080
1.00	655	2.00	2,400	2.90	5,090	3.80	8,475
1.10	770	2.10	2,650	3.00	5,445	3.90	8,875
1.20	895	2.20	2,915	3.10	5,805	4.00	9,280
1.30	1,030	2.30	3,190	3.20	6,170	4.20	10,090
1.40	1,180	2.40	3,480	3.30	6,540	4.40	10,910
1.50	1,345	2.50	3,780	3.40	6,915	4.60	11,730
1.60	1,525						

NOTE.—The above table is based on 12 discharge measurements made during 1904–5 and 1 measurement made in 1901. It is well defined between gage heights 0.7 foot and 2.3 feet. Above gage height 4.2 feet the rating curve is a tangent, the difference being 410 per tenth.

Monthly discharge of Hiwassee River at Reliance, Tenn., for 1906.

[Drainage area, 1,180 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	21,200	1,940	4,810	4.08	4.70
February	3,330	1,720	2,200	1.86	1.94
March	9,280	1,720	3,680	3.12	3.60
April	7,880	2,400	3,580	3.03	3.38
May	3,480	1,260	1,940	1.64	1.89
June	7,690	1,340	2,540	2.15	2.40
July	15,000	1,430	4,090	3.47	4.00
August	8,880	2,050	3,540	3.00	3.46
September	14,200	2,050	3,970	3.36	3.75
October	15,000	2,400	4,990	4.23	4.88
November	55,200	1,940	5,580	4.73	5.28
December	10,100	2,650	4,160	3.53	4.07
The year	55,200	1,260	3,760	3.18	43.35

NOTE.—Values for 1906 are excellent.

VALLEY RIVER AT TOMOTLA, N. C.

This station was established June 29, 1904. It is located at a footbridge about 250 feet below a public-road ford at Tomotla, N. C., and 5 miles above Murphy, N. C. A new gage for 1906 is at the right end of the footbridge. The lower 5.4 feet consists of a sloping section bolted to solid rock. The upper end is vertical and is fastened to the bridge abutment. An additional bench mark, consisting of a circle cut in solid rock under the right bank near the end of the footbridge,was established, having an elevation of 4.5 feet above the zero of the gage. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 135, where are given also references to publications that contain data for previous years.

Discharge measurements of Valley River at Tomotla, N. C., in 1904 to 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1904.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
December 15	M. R. Hall	55	101	1.10	69
1905.					
April 17	Olin P. Hall	58	150	1.79	204
June 16	M. R. Hall	55	125	1.42	125
June 16	O. P. Hall	56	125	1.42	118
October 13	do	55	110	1.20	78
1906.					
February	O. P. Hall	59	154	1.75	217
April 12	M. R. Hall	60	195	2.42	426
April 12	O. P. Hall	60	195	2.43	423
June 8	do	58	140	1.54	175
November 5	do	58	138	1.57	171

Daily gage height, in feet, of Valley River at Tomotla, N. C., 1905 and 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
1	1.4	1.3	2.1	1.85	2.45	1.75	2.3	1.4	1.5	1.05	1.15	1.45
2	1.4	1.4	2.1	1.85	2.25	1.65	2.2	1.4	1.4	1.05	1.05	1.6
3	1.4	1.4	2.0	1.85	2.05	1.65	1.8	1.3	1.4	1.55	1.05	7.75
4	1.4	1.5	1.9	1.75	1.95	1.55	1.8	1.3	1.4	1.35	1.05	3.55
5	1.5	1.7	1.9	1.75	1.85	1.55	1.6	1.3	1.4	1.25	1.05	2.65
6	1.9	2.4	1.9	1.85	1.85	1.45	2.0	1.3	1.3	1.15	1.05	2.35
7	1.9	2.1	1.8	1.85	2.15	1.45	1.8	1.4	1.3	1.15	1.25	1.95
8	1.7	3.1	1.8	2.05	2.05	1.45	1.6	1.8	1.3	1.15	1.15	3.35
9	1.5	7.9	2.6	2.35	1.95	1.35	1.6	1.5	1.3	1.15	1.15	4.55
10	1.6	3.7	2.8	2.05	1.95	1.35	1.8	2.0	1.3	1.35	1.15	2.75
11	1.8	2.9	2.5	1.85	1.85	1.35	2.1	1.8	1.3	2.55	1.15	2.45
12	7.5	2.9	2.3	2.45	1.85	1.25	9.6	2.3	1.2	1.75	1.15	2.35
13	3.7	3.9	2.2	2.05	1.85	1.25	4.2	2.6	1.2	1.35	1.15	2.35
14	2.7	3.3	2.1	1.95	1.85	1.35	2.6	3.2	1.2	1.15	1.05	2.25
15	2.5	2.7	2.0	1.85	2.15	1.35	2.4	2.1	1.2	1.15	1.05	2.35
16	2.1	2.6	2.0	2.15	3.15	1.35	2.2	2.8	1.2	1.15	1.05	2.35
17	1.9	2.4	1.9	1.85	2.45	1.35	2.4	2.2	1.2	1.15	1.05	2.25
18	1.7	2.2	1.85	1.85	2.25	1.35	2.2	1.8	1.2	1.05	1.05	2.15
19	1.7	2.7	1.8	1.85	2.05	1.35	2.1	1.6	1.2	1.25	1.15	2.15
20	1.6	7.6	2.2	1.75	1.95	1.35	2.0	1.6	1.2	1.15	1.55	2.15
21	1.6	5.4	3.4	1.75	2.05	1.45	1.8	1.5	1.1	1.15	1.35	2.75
22	1.6	3.9	2.5	1.95	2.05	1.45	1.8	1.6	1.1	1.15	1.25	2.35
23	1.5	3.1	2.2	1.85	2.35	1.65	1.7	1.8	1.1	1.15	1.15	3.75
24	1.4	2.9	2.3	1.85	2.35	1.45	1.7	2.9	1.1	1.15	1.15	3.55
25	1.3	2.7	2.3	1.85	2.05	1.35	1.7	1.8	1.1	1.15	1.45	2.75
26	1.2	2.5	2.1	2.05	1.95	1.45	1.6	1.7	1.1	1.85	1.35	2.35
27	1.1	2.3	2.1	1.95	1.85	1.45	1.6	1.6	1.1	1.55	1.25	2.25
28	1.1	2.2	2.0	1.85	1.85	1.45	1.5	1.6	1.0	1.25	1.35	2.15
29	1.1	.....	2.3	2.85	1.85	2.85	1.5	1.5	1.1	1.15	1.75	2.15
30	1.2	.....	2.1	3.15	1.85	2.85	1.5	1.5	1.1	1.15	1.65	2.05
31	1.4	.....	1.9	.....	1.75	.....	1.5	1.4	.....	1.15	.....	2.05
1906.												
1	1.85	2.25	1.85	2.4	1.95	1.35	1.7	2.1	1.9	3.0	1.7	2.1
2	1.95	2.15	1.95	2.2	1.9	2.5	1.7	3.2	1.8	3.0	1.7	2.1
3	4.6	2.15	3.2	2.1	1.85	1.5	1.65	2.6	1.8	3.0	1.7	2.0
4	4.8	2.05	2.35	2.3	2.3	1.5	1.6	2.4	1.8	2.8	1.65	2.0
5	3.1	2.05	2.15	2.8	2.0	1.4	1.7	2.1	1.75	3.0	1.65	2.1
6	2.75	2.05	2.05	2.4	2.0	1.4	1.7	2.2	2.9	6.0	1.6	2.8
7	2.45	1.95	2.05	2.1	2.0	1.35	1.9	2.3	2.6	4.0	1.55	2.4
8	2.25	1.95	2.25	2.2	1.9	1.3	1.7	2.1	2.1	3.4	1.55	2.1
9	2.15	1.85	2.05	4.6	1.9	1.3	1.6	2.1	2.0	3.0	1.5	2.1
10	2.15	1.85	1.95	3.4	1.85	1.25	1.6	2.0	1.9	2.6	1.5	2.8
11	2.15	1.85	1.85	2.8	1.8	1.25	1.55	2.0	1.8	2.4	1.5	2.6
12	2.35	1.85	1.85	2.6	1.8	2.0	1.55	2.0	1.75	2.2	1.6	2.4
13	2.25	1.75	1.95	2.4	1.75	2.0	1.5	2.0	1.7	2.1	1.6	2.3
14	2.25	1.75	2.45	2.4	1.75	2.5	4.8	2.0	1.6	2.05	1.7	2.2
15	2.25	1.75	3.8	2.4	1.7	4.4	4.0	2.1	1.5	2.0	1.8	2.3
16	2.25	1.65	2.85	2.3	1.65	3.2	3.0	1.9	1.6	2.0	1.8	2.5
17	2.35	1.65	2.45	2.3	1.6	3.0	3.6	1.9	2.6	2.1	1.8	4.1
18	2.45	1.65	2.25	2.25	1.55	2.4	4.5	1.8	2.4	2.8	4.5	3.2
19	2.35	1.65	3.4	2.25	1.55	2.2	3.3	1.9	2.0	2.4	17.3	3.6
20	2.25	1.75	3.1	2.2	1.5	2.0	3.0	2.1	2.1	2.2	6.0	3.0
21	2.25	2.25	2.65	2.2	1.5	2.5	2.4	2.0	2.3	2.1	4.0	2.9
22	2.35	1.95	2.45	2.1	1.45	2.0	2.2	1.9	2.3	2.0	3.6	2.8
23	5.6	1.75	2.25	2.05	1.45	2.0	2.2	1.8	3.2	2.0	3.2	2.6
24	4.2	1.75	2.15	2.05	1.4	3.0	2.1	1.8	2.8	1.9	3.0	2.6
25	3.4	1.65	2.05	2.0	1.4	2.4	2.0	1.75	2.4	1.9	2.9	2.5
26	2.65	1.65	2.05	2.0	1.6	2.0	1.9	1.8	2.3	1.8	2.8	2.5
27	2.65	1.85	2.15	2.0	1.5	1.9	2.4	3.0	2.4	1.8	2.7	2.8
28	2.45	1.85	2.45	2.3	1.45	1.8	2.0	2.6	2.6	1.75	2.6	4.0
29	2.45	.....	2.45	2.1	1.45	1.8	1.8	2.2	2.8	1.75	2.5	4.0
30	2.35	.....	3.8	2.0	1.4	1.6	2.5	2.0	5.0	1.7	2.4	3.6
31	2.25	.....	3.4	.....	1.4	.....	2.2	1.9	.....	1.7	.....	3.8

NOTE.—Gage heights for 1905 have been corrected for error in gage datum found in 1906.

Rating tables for Valley River at Tomotla, N. C.

JANUARY 1 TO DECEMBER 31, 1905.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	50	1.90	230	2.80	530	3.70	960
1.10	66	2.00	260	2.90	570	3.80	1,015
1.20	82	2.10	290	3.00	610	3.90	1,075
1.30	100	2.20	320	3.10	655	4.00	1,135
1.40	118	2.30	350	3.20	700	4.20	1,260
1.50	138	2.40	380	3.30	750	4.40	1,390
1.60	158	2.50	415	3.40	800	4.60	1,520
1.70	180	2.60	450	3.50	850	4.80	1,660
1.80	205	2.70	490	3.60	905	5.00	1,800

JANUARY 1 TO DECEMBER 31, 1906.[b]

1.20	92	2.10	315	3.00	635	3.80	1,040
1.30	112	2.20	345	3.10	680	3.90	1,100
1.40	134	2.30	375	3.20	725	4.00	1,160
1.50	156	2.40	405	3.30	775	4.20	1,285
1.60	180	2.50	440	3.40	825	4.40	1,415
1.70	205	2.60	475	3.50	875	4.60	1,545
1.80	230	2.70	515	3.60	930	4.80	1,680
1.90	255	2.80	555	3.70	985	5.00	1,820
2.00	285	2.90	595				

[a] This table is applicable only for open-channel conditions. It is based on four discharge measurements made during 1905. It is well defined between gage heights 1.0 feet and 2.0 foot. Above gage height 4.6 feet the rating curve is a tangent, the difference being 70 per tenth.

[b] This table is applicable only for open-channel conditions. It is based on five discharge measurements made during 1906. It is well defined between gage heights 1.2 feet and 3.0 feet. Above gage height 4.7 feet the rating curve is a tangent, the difference being 70 per tenth.

Monthly discharge of Valley River at Tomotla, N. C., for 1905 and 1906.

[Drainage area, 106 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
January	3,550	66	302	2.85	3.29
February	3,830	100	766	7.23	7.53
March	800	205	314	2.96	3.41
April	678	192	265	2.50	2.79
May	678	192	282	2.66	3.07
June	550	91	154	1.45	1.62
July	5,020	138	420	3.96	4.56
August	700	100	222	2.09	2.41
September	138	50	86.4	.815	.91
October	432	58	102	.962	1.11
November	192	58	85.2	.804	.90
December	3,720	128	559	5.27	6.08
The year	5,020	50	296	2.80	37.68
1906.					
January	2,240	242	574	5.42	6.25
February	360	192	250	2.36	2.46
March	1,040	242	446	4.21	4.85
April	1,540	285	419	3.95	4.41
May	375	134	204	1.92	2.21
June	1,420	102	325	3.07	3.42
July	1,680	156	434	4.09	4.72
August	725	217	325	3.07	3.54
September	1,820	156	393	3.71	4.14
October	2,520	205	483	4.56	5.26
November	10,400	156	803	7.58	8.46
December	1,220	285	562	5.30	6.11
The year	10,400	102	435	4.10	55.83

NOTE.—Values for 1905 and 1906 can be considered only fair, owing to discrepancies between the gage readings, probably due to daily fluctuations from stored water.

OKOEE RIVER AT M'CAYS, TENN.

This station was established March 21, 1903. It is located at a suspension footbridge just below McCay's ferry at McCays, Tenn., near the Georgia-Tennessee boundary, and one-half mile below the railroad bridge of the Louisville and Nashville Railroad. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 138, where are given also references to publications that contain data for previous years.

Discharge measurements of Okoee River at McCays, Tenn., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 12	O. P. Hall	153	544	1.63	925
April 18	do	156	616	1.98	1,130
June 11	do	152	501	1.33	733
November 3	do	153	525	1.57	848

Daily gage height, in feet, of Okoee River at McCays, Tenn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.4	2.1	1.5	2.75	1.8	1.4	1.3	2.3	2.1	3.25	1.6	1.9
2	1.3	2.0	1.5	2.4	1.75	2.45	1.35	2.35	2.0	3.75	1.6	1.9
3	4.4	1.9	2.7	2.1	1.9	1.65	1.6	2.1	1.9	3.5	1.6	1.9
4	4.4	1.9	2.45	2.1	2.05	1.55	1.5	2.05	1.85	3.1	1.55	1.8
5	2.8	1.9	1.8	2.0	1.75	1.75	1.35	1.85	2.2	2.75	1.5	1.85
6	2.4	1.8	1.6	2.0	1.7	1.55	1.3	2.2	2.05	3.7	1.5	1.95
7	2.05	1.8	1.6	1.9	1.65	1.4	1.5	1.85	1.9	3.05	1.5	1.9
8	2.0	1.7	1.8	1.9	1.8	1.35	1.55	1.85	1.9	2.75	1.5	1.7
9	2.0	1.7	1.7	2.6	1.7	1.4	1.7	1.8	1.8	2.5	1.45	1.7
10	1.95	1.6	1.6	2.2	1.65	1.35	1.4	1.7	2.4	2.4	1.4	2.65
11	1.9	1.5	1.6	2.0	1.65	1.45	1.35	1.7	1.9	2.3	1.6	2.75
12	2.0	1.6	1.5	2.0	1.6	1.4	1.5	1.65	2.1	2.2	1.5	2.2
13	1.95	1.6	1.5	1.9	1.6	4.0	1.3	2.3	1.8	2.2	1.5	2.05
14	1.9	1.6	1.65	2.2	1.5	2.65	4.3	2.3	1.75	2.1	1.5	1.85
15	1.8	1.5	4.8	2.7	1.5	3.8	2.85	2.2	1.65	2.0	1.5	1.8
16	1.85	1.5	2.6	2.1	1.45	2.15	2.15	2.1	1.6	2.0	1.5	1.85
17	1.7	1.5	2.15	2.05	1.45	1.8	3.8	1.65	1.5	2.0	1.6	2.05
18	1.8	1.4	2.15	1.9	1.4	1.85	4.4	1.8	1.5	2.45	7.0	2.1
19	1.7	1.45	3.6	1.9	1.4	1.7	2.95	1.95	3.4	2.3	18.5	2.05
20	1.65	1.45	3.4	1.9	1.4	1.65	2.65	2.15	2.3	2.0	8.0	2.25
21	1.65	1.9	2.7	1.8	1.35	1.5	2.55	1.9	1.95	1.9	3.2	2.1
22	3.8	1.65	2.45	1.8	1.35	1.45	3.3	1.9	2.05	1.9	2.95	1.95
23	6.5	1.5	2.25	1.8	1.3	1.4	3.6	2.15	2.05	1.85	2.55	1.95
24	3.2	1.5	2.1	1.7	1.3	3.8	2.3	2.05	2.3	1.8	2.4	1.9
25	2.8	1.5	2.05	1.7	1.2	1.8	2.1	1.95	2.0	1.8	2.3	1.8
26	2.7	1.4	2.05	1.65	2.0	1.65	2.55	1.8	1.9	1.8	2.2	1.8
27	2.8	1.55	2.1	2.0	1.9	1.5	2.15	1.7	1.8	1.7	2.2	1.7
28	2.4	1.4	2.1	2.9	1.5	1.5	2.0	1.7	1.8	1.7	2.1	2.2
29	2.4	.....	2.25	2.0	1.4	1.5	2.35	3.6	3.1	1.6	2.0	2.25
30	2.3	.....	3.0	1.9	1.3	1.4	2.55	3.3	4.6	1.6	1.9	2.1
31	2.2	.....	2.8	.....	1.3	.....	2.2	2.5	.....	1.6	.....	4.4

OKOEE RIVER NEAR DUCKTOWN, TENN.

Rating table for Okoee River at McCays, Tenn., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	640	2.30	1,315	3.40	2,075	5.00	3,360
1.30	695	2.40	1,380	3.50	2,150	5.20	3,540
1.40	750	2.50	1,445	3.60	2,225	5.40	3,730
1.50	810	2.60	1,510	3.70	2,300	5.60	3,930
1.60	870	2.70	1,580	3.80	2,375	5.80	4,130
1.70	930	2.80	1,650	3.90	2,450	6.00	4,330
1.80	990	2.90	1,720	4.00	2,530	6.20	4,530
1.90	1,055	3.00	1,790	4.20	2,690	6.40	4,740
2.00	1,120	3.10	1,860	4.40	2,850	6.60	4,960
2.10	1,185	3.20	1,930	4.60	3,015	6.80	5,180
2.20	1,250	3.30	2,000	4.80	3,185	7.00	5,400

NOTE.—The above table is applicable only for open-channel conditions. It is based on 4 discharge measurements made during 1906 and on the general form of the earlier curves. It is well defined between gage heights 1.0 foot and 3.5 feet. Above gage height 6.5 feet the rating curve is a tangent, the difference being 110 per tenth.

Monthly discharge of Okoee River at McCays, Tenn., for 1906.

[Drainage area, 374 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	4,850	695	1,450	3.88	4.47
February	1,180	750	896	2.40	2.50
March	3,180	810	1,280	3.42	3.94
April	1,720	900	1,160	3.10	3.46
May	1,150	640	853	2.28	2.63
June	2,530	722	1,050	2.81	3.14
July	2,850	695	1,300	3.48	4.01
August	2,220	900	1,170	3.13	3.61
September	3,020	810	1,200	3.21	3.58
October	2,340	870	1,330	3.56	4.10
November	18,000	750	1,920	5.13	5.72
December	2,850	930	1,180	3.16	3.64
The year	18,000	640	1,230	3.29	44.80

NOTE.—Values for 1906 are excellent.

ELK RIVER NEAR ELKMONT, ALA.

This station was established June 24, 1904. It is located at the wagon bridge near Wilson's store, about 5 miles east of Elkmont, Ala., and 3 miles below the bridge of the Louisville and Nashville Railroad. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 141, where are given also references to publications that contain data for previous years.

Discharge measurements of Elk River near Elkmont, Ala., in 1905 and 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 12	W. E. Hall	235	629	2.71	1,380
June 19	F. A. Murray	232	590	2.51	1,160
September 30	do	201	360	1.51	315
November 28	W. E. Hall	202	414	1.81	461
1906.					
March 22	W. E. Hall	233	847	3.58	2,800
May 10	F. A. Murray	230	508	2.41	1,050
June 23	O. P. Hall	221	400	1.75	463
October 26	F. A. Murray	231	606	2.53	1,190
October 26	do	231	605	2.54	1,210
December 11	W. E. Hall	230	583	2.50	1,200

Daily gage height, in feet, of Elk River near Elkmont, Ala., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.8	3.85	2.7	8.6	2.75	2.5	1.75	2.9	2.0	13.3	2.2	2.3
2	3.9	3.5	3.0	6.8	2.6	2.8	1.7	2.7	2.0	9.8	2.2	2.4
3	6.3	3.3	8.7	5.3	2.6	2.7	1.65	2.55	2.0	13.3	2.15	2.5
4	5.6	3.3	10.7	4.8	2.7	2.6	1.85	2.5	2.15	11.3	2.15	2.55
5	4.9	3.25	5.9	4.6	2.6	3.0	1.7	2.45	2.2	8.3	2.15	2.55
6	4.4	3.15	4.8	4.4	2.65	2.5	1.9	2.6	2.2	12.3	2.1	2.5
7	4.4	3.1	4.1	4.2	2.85	2.4	1.7	2.1	2.1	10.0	2.1	2.7
8	4.4	3.0	3.9	3.8	2.75	2.2	1.8	2.0	2.0	8.2	2.15	2.7
9	4.3	2.9	3.7	3.4	2.5	2.15	1.75	2.0	2.1	5.9	2.15	2.5
10	4.0	2.9	3.55	4.2	2.4	2.4	1.8	1.9	2.3	5.1	2.15	2.5
11	4.0	2.85	3.35	4.0	2.3	2.2	1.7	2.0	4.3	4.4	2.1	2.5
12	7.0	2.8	3.15	3.8	2.3	2.05	1.6	2.2	3.0	4.0	2.1	4.4
13	6.0	2.8	3.05	3.4	2.15	2.5	2.2	2.9	2.4	4.0	2.1	4.4
14	5.5	2.75	4.4	3.2	2.2	2.35	3.5	3.4	2.4	3.9	2.05	4.4
15	5.0	2.75	7.1	3.3	2.3	2.5	3.2	3.4	2.3	3.8	2.07	4.5
16	5.0	2.7	5.6	3.2	2.2	2.1	2.35	3.65	2.2	3.15	2.1	6.3
17	5.5	2.6	4.6	3.05	2.2	2.05	2.7	3.1	2.1	3.1	2.15	9.6
18	4.6	2.55	4.4	3.0	2.1	2.0	3.0	2.9	2.0	3.0	2.2	8.0
19	5.0	2.5	4.1	2.95	2.0	1.9	3.3	2.6	7.9	3.15	3.8	6.7
20	4.6	2.5	4.0	2.8	2.0	1.8	2.7	2.45	4.2	3.1	6.8	5.6
21	4.4	2.5	3.9	2.7	1.9	1.8	3.35	2.2	3.0	3.0	6.3	5.0
22	9.1	2.55	3.7	2.6	2.4	1.8	3.0	2.0	3.85	2.9	5.8	4.9
23	12.5	2.6	3.4	2.8	1.9	1.8	2.8	2.2	5.8	2.8	4.2	4.4
24	14.0	2.6	3.3	2.6	1.9	1.75	3.5	2.3	4.0	2.7	3.8	3.75
25	11.4	2.65	3.2	2.55	1.85	2.1	3.3	2.4	3.4	2.6	3.5	3.5
26	7.5	2.75	3.1	2.5	4.0	1.9	2.85	2.5	4.5	2.5	3.5	3.45
27	5.9	2.8	3.75	3.8	3.2	1.9	2.55	2.4	3.4	2.5	3.1	3.2
28	5.1	2.8	4.8	3.15	3.05	1.8	2.35	2.3	7.6	2.2	3.0	4.4
29	4.7	.....	5.3	3.25	3.15	1.8	4.0	2.2	16.4	2.2	2.8	5.7
30	4.6	.....	11.5	2.9	3.1	1.75	3.7	2.1	18.5	2.3	2.5	6.0
31	4.5	.....	5.6	.....	2.7	.....	3.25	2.0	.....	2.3	.....	11.2

Rating table for Elk River near Elkmont, Ala., for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	315	2.60	1,270	3.70	3,030	5.60	7,520
1.60	375	2.70	1,400	3.80	3,220	5.80	8,080
1.70	440	2.80	1,530	3.90	3,420	6.00	8,640
1.80	510	2.90	1,670	4.00	3,620	6.20	9,210
1.90	585	3.00	1,820	4.20	4,040	6.40	9,790
2.00	660	3.10	1,970	4.40	4,490	6.60	10,380
2.10	740	3.20	2,130	4.60	4,950	6.80	10,980
2.20	830	3.30	2,300	4.80	5,430	7.00	11,600
2.30	930	3.40	2,480	5.00	5,930	8.00	14,800
2.40	1,040	3.50	2,660	5.20	6,450		
2.50	1,150	3.60	2,840	5.40	6,980		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904 to 1906. It is well defined between gage heights 1.2 feet and 4.0 feet. Above gage height 7.0 feet the rating curve is a tangent, the difference being 320 per tenth.

Monthly discharge of Elk River at Elkmont, Ala., for 1906.

[Drainage area, 1,700 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	34,000	3,220	8,740	5.14	5.93
February	3,320	1,150	1,660	.976	1.02
March	26,000	1,400	5,860	3.45	3.98
April	16,700	1,150	3,430	2.02	2.25
May	3,620	548	1,220	.718	.83
June	1,820	475	848	.499	.56
July	3,620	375	1,370	.806	.93
August	2,940	585	1,200	.706	.81
September	48,400	660	5,580	3.28	3.66
October	31,800	830	7,960	4.68	5.40
November	11,000	700	2,160	1.27	1.12
December	25,000	930	5,350	3.15	3.63
The year	48,400	375	3,782	2.22	30.42

NOTE.—Values are rated as follows: February and March, 1905, and January, September, and October, 1906, good; remainder of 1905 and 1906, excellent.

DUCK RIVER AT COLUMBIA, TENN.

This is an old Weather Bureau station that has not been maintained continously. Discharge measurements were made during 1904 and gage heights have been regularly recorded since October 21, 1904. The station is located at the highway bridge two blocks north of the public square at Columbia, Tenn. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 143, where are given also references to publications that contain data for previous years. A new gage, established June 17, 1905, is set at the same datum with the old gage of the United States Weather Bureau, which is a vertical timber 38 feet long bolted to the downstream side of the right-bank pier.

Discharge measurements of Duck River near Columbia, Tenn., 1901 to 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1901.					
February 9	M. R. Hall	138	1,100	3.60	2,420
April 19	do	175	2,380	11.90	9,500
1904.					
May 21	J. M. Giles	85	610	.70	299
August 18	do	115	755	.70	287
August 18	do	115	725	.70	284
October 21	do	79	139	.44	130
October 21	do	79	144	.40	158
1905.					
April 14	W. E. Hall	115	772	1.21	533
June 16	F. A. Murray	134	823	1.63	756
June 17	do	136	863	1.97	1,040
June 20	do	121	772	1.34	599
September 29	do	86	95	.60	135
November 27	W. E. Hall	115	718	.77	267
1906.					
March 23	W. E. Hall	120	847	1.90	951
May 11	F. A. Murray	116	752	1.02	412
May 11	do	116	752	1.00	434
June 25	O. P. Hall	112	713	0.94	348
October 27	F. A. Murray	119	761	1.12	465
October 27	do	119	761	1.10	451
December 12	W. E. Hall	115	749	1.15	478

Daily gage height, in feet, of Duck River near Columbia, Tenn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.6	2.55	1.3	9.4	2.0	1.6	0.55	2.15	0.85	8.2	0.9	1.55
2	2.55	2.3	1.35	6.2	1.65	2.0	.6	1.6	.75	9.9	.95	1.45
3	3.3	2.15	8.2	4.7	1.45	1.5	.8	1.15	.65	13.9	.85	1.35
4	5.5	1.95	8.2	3.8	1.35	1.2	.8	1.15	.6	12.4	.85	1.3
5	4.6	1.7	4.4	3.0	1.3	1.15	.7	1.05	.75	9.8	.8	1.25
6	3.7	1.6	2.9	3.4	1.3	1.25	.65	1.15	1.6	15.2	.85	1.25
7	3.0	1.6	2.75	3.4	1.35	1.15	.7	0.95	1.05	13.0	.8	1.2
8	2.8	1.55	2.6	2.8	1.25	1.1	1.5	0.8	.85	8.3	.8	1.3
9	3.6	1.45	2.45	3.8	1.15	1.0	.95	0.8	.85	5.4	.8	1.2
10	3.2	1.35	2.3	3.4	1.15	.85	.75	1.3	1.95	3.9	.75	1.2
11	3.4	1.3	1.95	2.7	1.05	.9	.7	1.3	2.55	3.0	.8	1.2
12	7.6	1.25	1.85	2.35	.9	.85	.65	2.35	4.0	2.5	.8	1.15
13	7.4	1.2	1.75	2.25	.8	1.1	.6	2.3	2.45	2.25	.8	1.1
14	5.8	1.2	2.15	2.65	.8	1.1	1.7	2.3	1.65	1.85	.85	1.1
15	4.6	1.2	2.75	2.0	.9	1.0	1.2	1.6	1.25	1.6	.95	1.15
16	4.0	1.2	2.95	1.85	.75	.9	1.0	1.55	.95	1.35	.85	1.6
17	3.6	1.15	2.75	1.8	.8	.85	10.3	1.4	.85	1.4	1.15	10.4
18	3.0	1.05	2.55	1.6	.8	.8	10.4	1.25	.8	1.55	10.6	13.5
19	2.9	1.1	2.4	1.5	.75	.8	4.9	1.5	.95	1.6	13.3	8.4
20	2.65	1.1	2.4	1.45	.7	.8	3.6	1.25	1.2	1.8	9.8	6.2
21	2.5	1.1	2.25	1.4	.65	.75	4.0	1.2	2.4	1.7	7.2	5.1
22	13.8	1.2	2.05	1.4	.6	.65	3.4	1.2	3.1	1.55	5.2	4.6
23	26.4	1.25	1.9	1.3	.6	.7	2.5	2.85	7.5	1.4	3.7	3.7
24	24.2	1.3	1.75	1.3	.6	.95	2.5	2.35	4.2	1.25	3.0	3.2
25	9.6	1.3	1.7	1.2	.8	.75	2.3	1.75	2.65	1.15	2.75	2.95
26	5.8	1.3	1.6	1.15	2.5	.75	1.8	2.1	3.1	1.1	2.3	2.5
27	4.8	1.3	10.4	4.1	2.75	.65	1.4	1.7	2.7	1.1	2.05	2.2
28	3.9	1.3	11.0	3.1	2.25	.6	1.15	1.25	6.2	1.05	1.85	2.5
29	3.4	.....	17.2	3.2	2.05	.55	1.2	1.15	20.9	0.95	1.8	4.2
30	3.0	.....	22.6	2.05	1.6	.5	2.1	1.05	9.9	1.0	1.65	6.8
31	2.75	.....	17.1	.....	1.15	.....	3.6	0.95	.....	0.95	.....	17.9

Rating tables for Duck River near Columbia, Tenn.

OCTOBER 21, 1904, TO DECEMBER 24, 1904.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.30	80	0.60	222	0.90	408	2.00	1,200
0.40	122	0.70	280	1.00	475	2.50	1,600
0.50	170	0.80	342	1.50	825		

DECEMBER 25, 1904, TO DECEMBER 31, 1906.[b]

0.40	60	1.20	510	2.00	1,080	2.80	1,730
0.50	100	1.30	580	2.10	1,160	2.90	1,815
0.60	145	1.40	650	2.20	1,240	3.00	1,900
0.70	195	1.50	720	2.30	1,320	3.10	1,990
0.80	250	1.60	790	2.40	1,400	3.20	2,080
0.90	310	1.70	860	2.50	1,480		
1.00	375	1.80	930	2.60	1,560		
1.10	440	1.90	1,005	2.70	1,645		

[a] This table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1904 and on the form of the 1905–6 curve.

[b] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1901, 1905, and 1906. It is well defined between gage heights 0.5 foot and 4.0 feet. Above gage height 4.0 feet it is based on a discharge measurement at gage height 11.90 made in 1901. Above gage height 3.00 feet the rating curve is a tangent, the difference being 90 per tenth.

Monthly discharge of Duck River near Columbia, Tenn., for 1904 to 1906.

[Drainage area, 1,260 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1904.					
October 21–31	170	80	133	0.106	0.04
November	280	80	137	.109	.12
December	14,000	101	1,730	1.37	1.58
1905.					
January	11,800	310	1,990	1.58	1.82
February	14,700	80	4,210	3.34	3.48
March	17,800	755	3,080	2.44	2.81
April	1,360	250	621	.493	.55
May	25,600	440	3,500	2.78	3.20
June	9,460	280	1,960	1.56	1.74
July	8,380	170	1,210	.960	1.11
August	2,980	100	654	.519	.60
September	3,340	100	387	.307	.34
October	3,340	80	1,050	.833	.96
November	685	145	307	.244	.27
December	9,460	510	3,050	2.42	2.79
The year	25,600	80	1,830	1.46	19.67
1906.					
January	23,000	1,480	4,430	3.51	4.05
February	1,520	408	675	.536	.56
March	19,500	580	3,600	2.86	3.30
April	7,660	475	1,800	1.43	1.60
May	1,690	145	543	.431	.50
June	1,080	100	350	.286	.32
July	8,560	122	1,400	1.11	1.28
August	1,770	250	731	.580	.67
September	18,000	145	2,040	1.62	1.81
October	12,900	342	3,160	2.51	2.89
November	11,200	222	1,790	1.42	1.58
December	15,300	440	2,640	2.10	2.42
The year	23,000	100	1,930	1.53	20.98

NOTE.—Values are rated as follows: October, 1904, to March, 1905, May and December, 1905, and January, March September, October, and December, 1906, good; all remaining months, excellent.

MISCELLANEOUS MEASUREMENTS IN TENNESSEE RIVER DRAINAGE BASIN.

The following is a list of miscellaneous discharge measurements made in Tennessee River drainage basin during 1906:

French Broad River at Oldtown, Tenn.—This was originally one of the temporary stations established in connection with the general hydrographic study of the southern Appalachian region. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 93, where are given also references to publications that contain data for previous years.

The following discharge measurement was made May 25, 1906:

Width, 379 feet; area, 1,600 square feet; gage height, 1.67 feet; discharge, 2,010 second-feet.

Swannanoa River at Biltmore, N. C.—This station was established May 21, 1904, for the purpose of making miscellaneous measurements. It is located at the Biltmore, N. C., terminal of the Asheville-Biltmore electric railway line, about three-fourths mile above the mouth of Swannanoa River. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 95, where are given also references to publications that contain data for previous years.

The following discharge measurement was made April 16, 1906:

Width, 80 feet; area, 266 square feet; gage height, 2.35 feet; discharge, 617 second-feet.

Avery Creek at Davidsons River, N. C.—This station was established May 19, 1904, for the purpose of making miscellaneous measurements. It is located about one-fourth mile above the junction of Avery Creek with Davidsons River and a less distance from the regular gaging station on the latter stream. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 104, where are given also references to publications that contain data for previous years.

The following measurement was made June 15, 1906:

Width, 23 feet; area, 42 square feet; gage height, 2.80 feet; discharge, 169 second-feet.

Pigeon River at Newport, Tenn.—This station is located at the highway bridge in the eastern part of Newport, Tenn., 1 mile from the railroad station and 1 mile above the dam of the Newport Flouring Mill, out of reach of backwater. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 110, where are given also references to publications that contain data for previous years.

The following discharge measurement was made May 24, 1906:

Width, 186 feet; area, 608 square feet; gage height, 1.34 feet; discharge, 663 second-feet.

Doe River at Elizabethton, Tenn.—This station was established May 22, 1904, for the purpose of making miscellaneous measurements. It is located at the covered wagon bridge in the town of Elizabethton, Tenn. The conditions at this station and the bench marks are described in Water-Supply Paper No. 169, page 121, where are given also references to publications that contain data for previous years.

The following discharge measurement was made October 23, 1906:

Width, 129 feet; area, 281 square feet; gage height, 1.63 feet; discharge, 318 second-feet.

Little Tennessee River at Almond, N. C.—This station is located at a suspension footbridge across Little Tennessee River, about one-fourth mile above its junction with Nantahala River and about 300 feet from the station at the Southern Railway bridge on Nantahala River. The section is about 200 feet wide; the bed is very rough and the current moderately swift. Gage heights for discharge measurements are determined by measuring down from a bench mark, which consists of 3 nails driven in the upstream side of an elm tree on the left bank of river, 20 feet upstream from the footbridge; elevation, 8.00 feet above gage datum.

The following discharge measurement was made June 9, 1906:

Width, 187 feet; area, 398 square feet; gage height, 2.27 feet; discharge, 938 second-feet.

Nantahala River at Almond, N. C.—This station is located at the Southern Railway bridge crossing Nantahala River about one-fourth mile above its junction with Little Tennessee River. Discharge measurements are made from the railroad bridge. The section is about 160 feet wide and is shallow and very swift, but fairly good for measurements. Only low-water measurements are made and the gage heights are determined from a bench mark, there being no gage. The bench mark is the center of the bolt or pin connecting the intermediate post and the floor beam at the middle of the left span on the upstream side of the bridge; elevation, 15.00 feet above gage datum.

The following discharge measurement was made June 8, 1906:

Width, 121 feet; area, 166 square feet; gage height, 1.12 feet; discharge, 649 second-feet.

Fightingtown Creek at McCays, Tenn.—This station was established August 27, 1904, for the purpose of making miscellaneous measurements. It is located about one-half mile above the mouth of the creek, which flows into Okoee River about one-half mile below the gaging station on Okoee River at McCays, Tenn. The conditions at

this station and the bench marks are described in Water-Supply Paper No. 169, page 140, where are given also references to publications that contain data for previous years.

The following discharge measurements were made in 1906:

April 19: Width, 43 feet; area, 164 square feet; gage height, 2.85 feet; discharge, 241 second-feet. June 12: Width, 40 feet; area, 130 square feet; gage height, 2.25 feet; discharge, 129 second-feet.

Paint Rock River near Paintrock, Ala.—This station is located at the highway bridge 2¾ miles south of Paintrock, Ala., and about 400 feet above the Southern Railway bridge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 128, page 149.

Discharge measurements of Paint Rock River near Paintrock, Ala., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft*
May 12	F. A. Murray	63	248	1.31	118
June 26	O. P. Hall	65	222	1.13	87
October 29	F. A. Murray	64	266	1.51	155

Flint River at Brownsboro, Ala.—This station is located at the highway bridge about one-fourth mile west of Brownsboro, Ala., and 100 feet below a 6-foot milldam. The conditions at this station and the bench marks are described in Water-Supply Paper No. 128, page 150.

Discharge measurements of Flint River at Brownsboro, Ala., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft*
May 12	F. A. Murray	140	450	1.89	224
June 22	O. P. Hall	140	398	1.65	178
October 29	F. A. Murray	144	454	2.01	237

LOWER EASTERN MISSISSIPPI RIVER DRAINAGES.

The streams flowing into Mississippi River from the east below the mouth of the Ohio are in the main comparatively small. In the lower portion they are practically a network of bayous. The following pages contain the results of data collected in the lower eastern Mississippi River drainage by the United States Geological Survey during 1906:

YAZOO RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Yazoo River rises in the northwestern part of Mississippi. It flows southward just west of the central portion of the State and enters Mississippi River just above Vicksburg.

TALLAHATCHIE RIVER AT BATESVILLE, MISS.

This station was established on June 15, 1906. It is located at the county highway bridge 1 mile west of Batesville and about 2 miles below the crossing of the Illinois Central Railroad. The bridge from which discharge measurements are made is a single steel span 220 feet long, with wooden approaches at both ends.

Both banks will overflow at high floods, sometimes beyond the ends of the bridge approaches. The bed is mostly firm sand, and the current is fairly good. An island about 300 feet below the station divides the river into two channels, the combined width of which appears to be less than that of the river above, making the water swifter.

The boxed-chain gage is bolted to the upstream lower chord in the third panel from the left bank; length of chain, 29.96 feet. The gage is read once a day by J. S. Goff.

The reference point is the top of the downstream end of the third floor beam from the left-bank end of the bridge; elevation, 27 feet above gage datum.

Discharge measurements of Tallahatchie River at Batesville, Miss., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 17	W. E. Hall	146	679	4.13	1,020
June 15	M. R. Hall	135	507	2.92	584
September 20	do	128	393	2.33	468

Daily gage height, in feet, of Tallahatchie River at Batesville, Miss., for 1906.

Day.	June.	July.	Sept.	Oct.	Nov.	Dec.	Day.	June.	July.	Sept.	Oct.	Nov.	Dec.
1		2.8		9.0	3.1	14.2	17	2.85	5.2		11.0	3.0	13.7
2		3.8		10.6	3.1	13.0	18	2.8	5.1		7.8	2.95	13.3
3		2.75		12.2	3.1	11.1	19	2.8	4.6		5.2	2.95	13.1
4		2.75		13.0	3.1	8.3	20	2.8	4.8	2.3	4.0	9.0	13.1
5		2.7		13.6	3.0	6.5	21	2.8	5.1	2.45	4.0	18.0	13.1
6		2.7		14.1	3.0	6.8	22	2.85	4.7	4.0	4.0	18.6	13.0
7		2.7		14.0	3.0	7.0	23	2.8	4.3	3.9	3.6	18.2	13.2
8		2.8		14.0	3.0	6.9	24	2.8	3.5	3.8	3.8	18.1	13.1
9		2.9		13.9	3.0	7.0	25	2.9	3.2	3.3	3.6	17.9	13.0
10		2.85		13.4	3.0	8.0	26	3.5	2.8	3.2	3.6	17.4	12.7
11		2.9		13.3	3.0	8.0	27	2.9	2.75	3.1	3.6	16.9	12.6
12		3.0		13.3	3.0	7.8	28	2.85	2.6	10.0	3.2	16.5	12.1
13		3.4		13.6	3.0	7.6	29	2.8	2.5	9.6	3.2	16.0	9.6
14		3.0		13.3	3.0	7.7	30	2.8	2.6	8.6	3.2	15.0	8.3
15	2.9	2.8		13.0	3.0	8.0	31		2.55		3.2		8.6
16	2.85	3.5		12.0	3.0	11.0							

YALOBUSHA RIVER AT GRENADA, MISS.

This station was established on June 14, 1906. It is located in the western part of Grenada at the county highway bridge, about one-half mile from the depot and the same distance below the cross-

ing of the Illinois Central Railroad. The bridge from which measurements are made is 260 feet long, there being a main span of 160 feet across the river and two short spans of 50 feet each on the right bank.

Both banks of the river are high and not liable to overflow. The current is fairly swift and regular. The bed is sandy and is liable to shift, but conditions below the station will probably cause the rating to remain constant.

The boxed chain gage is bolted to a special timber, which is itself bolted to the intermediate post and diagonal brace on the downstream side of the bridge in the fourth panel from the left bank; length of chain, 40.71 feet.

The reference point is the top of the downstream corner of a plate near bridge floor on the right side of the intermediate post at downstream end of the third floor beam from the left bank: elevation, 37.94 feet above gage datum.

Discharge measurements of Yalobusha River at Grenada, Miss., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec-ft.*
March 19	W. E. Hall	118	1,190	11.20	[illegible]
May 2	do	80	136	1.85	[illegible]
June 14	M. R. Hall	79	132	1.52	[illegible]
September 19	do	78	121	1.22	[illegible]
September 19	do	78	120	1.22	[illegible]

Daily gage height, in feet, of Yalobusha River at Grenada, Miss., for 1906.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		2.3	1.2	1.0	13.3	1.4	17	3.3	4.3		1.2	2.7	[illegible]
2		2.2		.9	13.8	1.4	18	2.5	4.1		1.0	2.35	[illegible]
3		1.5		.9	13.4	1.4	19	2.3	4.2		1.2	2.1	[illegible]
4		1.4		.9	12.8	1.45	20	1.9	4.3		1.2	2.0	[illegible]
5		1.1		2.8	18.3	1.4	21	1.7	4.1		1.5	1.9	[illegible]
6		1.1		3.3	18.8	1.35	22	1.5	3.7		1.9	[illegible]	[illegible]
7		1.3		2.8	17.9	1.35	23	1.4	3.2		1.35	1.7	[illegible]
8		1.3		2.8	17.6	1.35	24	1.3	3.9		1.8	[illegible]	[illegible]
9		1.3		2.3	16.6	1.35	25	1.4	3.2		1.55	[illegible]	[illegible]
10		1.2		1.9	15.3	1.35	26	2.1	2.3	1.5	2.45	[illegible]	[illegible]
11		2.0		1.7	13.4	1.35	27	1.3	1.8	1.9	11.0	[illegible]	[illegible]
12		2.7		1.4	8.6	1.35	28	1.2	1.6	1.5	14.4	[illegible]	[illegible]
13		2.8		1.3	7.0	1.35	29	1.1	1.4	1.2	13.7	[illegible]	[illegible]
14	1.5	2.7		1.3	6.5	1.35	30	1.1	1.3	1.1	12.5	[illegible]	[illegible]
15	2.2	2.7		1.2	4.4	1.35	31		1.3	1.0		[illegible]	[illegible]
16	4.0	2.4		1.1	3.2	1.35							

HOMOCHITTO RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Homochitto River drains a small area in the southwestern part of the State of Mississippi. It rises in the southwestern part of Copiah County and flows in a southwesterly direction into Mississippi River. The United States Geological Survey maintains one station on the river at Rosetta, Miss.

HOMOCHITTO RIVER AT ROSETTA, MISS.

This station was established June 16, 1906. It is located at the Yazoo and Mississippi Valley Railroad bridge in the town of Rosetta.

The river at high stages will overflow the right bank under the bridge trestle and will overflow left bank under the trestle and through short opening in the embankment. The bed of the river is sand and may shift considerably.

The chain gage is attached to the downstream guard rail at the first floor beam from the right end of the bridge; length of chain from end of weight to marker, 34.79 feet. The gage is read once a day by William Z. Taylor.

The reference point is the top of the extreme downstream end of the first floor beam from the right-bank pier; elevation, 30 feet above gage datum.

Discharge measurements of Homochitto River at Rosetta, Miss., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 30	W. E. Hall	125	846	5.75	704
June 16	M. R. Hall	96	451	3.51	308
September 22	do	92	476	3.78	391

Daily gage height, in feet, of Homochitto River at Rosetta, Miss., for 1906.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.75	3.5	3.0	4.8	3.7	17	3.5	5.5	3.9	3.2	3.9	.....
2	.....	3.5	3.4	3.15	4.3	3.6	18	3.4	7.0	3.7	3.1	4.7	.....
3	.....	5.4	3.3	3.1	6.0	3.6	19	3.5	7.8	3.6	3.0	4.65	.....
4	.....	4.35	4.2	3.6	5.9	3.7	20	3.6	6.1	3.6	2.95	4.4	.....
5	.....	3.9	5.5	4.5	6.8	3.6	21	3.1	4.5	3.5	4.35	4.2	.....
6	.....	3.5	4.7	5.0	9.9	3.6	22	3.2	6.8	3.9	3.5	4.6	.....
7	.....	3.0	3.7	4.4	8.9	3.5	23	3.3	6.8	3.6	3.0	4.1	.....
8	.....	3.25	3.6	4.0	8.3	3.5	24	3.35	4.8	4.0	3.8	4.0	.....
9	.....	3.4	3.7	3.7	8.8	3.5	25	3.15	4.1	3.1	3.3	3.9	.....
10	.....	5.5	3.2	3.4	7.0	3.6	26	3.7	3.8	4.5	3.6	3.9	.....
11	.....	5.6	3.1	3.3	6.1	3.6	27	3.6	3.7	4.7	3.9	3.7	.....
12	.....	5.9	3.0	6.2	5.5	3.5	28	3.6	3.7	4.55	6.4	3.7	.....
13	.....	7.8	3.3	3.95	5.3	.....	29	3.95	4.9	3.7	8.8	3.8	.....
14	.....	6.6	3.5	3.4	5.0	.....	30	3.6	4.4	3.2	4.9	3.8	.....
15	.....	5.6	3.4	3.4	4.9	.....	31	.....	3.9	3.1	.....	3.7	.....
16	3.5	6.0	3.1	3.3	4.7	.....							

INDEX.

A. Page.

Acknowledgments and cooperation..... 22
Acre-foot, definition of..... 10
Alderson, W. Va.,
Greenbrier River at:
description..... 47
discharge..... 48
discharge, monthly..... 48
gage heights..... 48
rating table..... 48
Allegheny River at—
Kittanning, Pa.:
description..... 30
discharge..... 31
discharge, monthly..... 32
gage heights..... 30
rating table..... 30
Redhouse, N. Y.:
description..... 28
discharge..... 29
discharge, monthly..... 30
gage heights..... 29
rating table..... 29
Allegheny River basin:
description of..... 27-28
stream data..... 28-33
Almond, N. C.,
Little Tennessee River at:
description..... 111
discharge..... 111
Nantahala River at:
description..... 111
discharge..... 111
Asheville, N. C.,
French Broad River (at Smith Bridge) near:
description..... 72
discharge..... 72
discharge, monthly..... 73
gage heights..... 72
rating table..... 73
Austins Mills, Tenn.,
Holston River at:
description..... 87
discharge..... 88
discharge, monthly..... 89
gage heights..... 88
rating table..... 88
Avery Creek at—
Davidsons River, N. C.:
description..... 110
discharge..... 110

B.

Batesville, Miss.,
Tallahatchie River at:
description..... 113
discharge..... 113
gage heights..... 113

Page.

Beaver River basin:
description of..... 39
stream data..... 39-41
Biltmore, N. C.,
Swannanoa River at:
description..... 110
discharge..... 110
Blacklick, Pa.,
Blacklick Creek at:
description..... 32
discharge..... 32
discharge, monthly..... 33
gage heights..... 32
rating table..... 33
Blacklick Creek at—
Blacklick, Pa.:
description..... 32
discharge..... 32
discharge, monthly..... 33
gage heights..... 32
rating table..... 33
Bluff City, Tenn.,
Holston River (South Fork) at:
description..... 85
discharge..... 85
discharge, monthly..... 87
gage heights..... 86
rating table..... 86
Bolster, R. H., work of..... 7
Brennan, M. S., work of..... 7
Brownsboro, Ala.,
Flint River at:
description..... 112
discharge..... 112
Bryson, N. C.,
Tuckasegee River at:
description..... 95
discharge..... 95
discharge, monthly..... 97
gage heights..... 96
rating table..... 96

C.

Cable station, figure showing..... 17
Casselman River at—
Confluence, Pa.:
description..... 35
discharge..... 36
discharge, monthly..... 37
gage heights..... 36
rating table..... 36
Cataract, Ind.,
Eel River at:
description..... 68
gage heights..... 68
Chattanooga, Tenn.,
Tennessee River at:
description..... 75
discharge..... 75

Chattanooga, Tenn.—Continued. Page.
Tennessee River at:
discharge, monthly 77
gage heights 76
rating table 76
Columbia, Tenn.,
Duck River at:
description 107
discharge 108
discharge, monthly 109
gage heights 108
rating table 109
Columbus, Ohio,
Olentangy River near:
description 50
discharge 50
Scioto River near:
description 49
discharge, monthly 50
gage heights 49
rating table 50
Computation, methods of 19-22
Confluence, Pa.,
Casselman River at:
description 35
discharge 36
discharge, monthly 37
gage heights 36
rating table 36
Laurel Hill Creek at:
description 37
discharge 38
discharge, monthly 39
gage heights 38
rating table 38
Youghiogheny River near:
description 34
discharge 34
discharge, monthly 35
gage heights 34
rating table 35
Cooperation and acknowledgments 22
Current meters, classes of 16
methods of using 16-19
plate showing 16
Current-meter station, plate showing 16
Curves (discharge, area, and velocity), figure showing 21

D.

Davidsons River, N. C.,
Avery Creek at:
description 110
discharge 110
Davidsons River near:
description 77
discharge 77
discharge, monthly 79
gage heights 78
rating table 78
Dayton, Ohio,
Miami River at:
description 55
discharge 56
discharge, monthly 57
gage heights 56
rating table 57
Definitions of terms used 9-10
Delphi, Ind., Page.
Tippecanoe River near:
description 64
discharge 64
discharge, monthly 65
gage heights 65
horsepower 66
rating table 65
Discharge, measurement and computation of 13-22
Doe River at—
Elizabethton, Tenn.:
description 111
discharge 111
Drainage basins, list of 8-9
map showing 7
Duck River at—
Columbia, Tenn.:
description 107
discharge 108
discharge, monthly 109
gage heights 108
rating tables 109

E.

East Branch of White River. *See* White River (East Branch).
Eel River at—
Cataract, Ind.:
description 68
gage heights 68
Elizabethton, Tenn.,
Doe River at:
description 111
discharge 111
Watauga River near:
description 89
discharge 90
discharge, monthly 91
gage heights 90
rating table 90
Elk River near—
Elkmont, Ala.:
description 105
discharge 106
discharge, monthly 107
gage heights 106
rating table 107
Elkmont, Ala.,
Elk River near:
description 105
discharge 106
discharge, monthly 107
gage heights 106
rating table 107
Equivalents, table of 12-13

F.

Flint River at—
Brownsboro, Ala.:
description 112
discharge 112
Floats, use of, in measuring discharge 15-16
Follansbee, Robert, work of 7
Frankfort, Ky.,
Kentucky River at:
description 57
discharge 58
gage heights 58

French Broad River at and near— Page.
Asheville, N. C.:
description 72
discharge 72
discharge, monthly 73
gage heights 72
rating table 73
Horseshoe, N. C.:
description 70
discharge 70
discharge, monthly 71
gage heights 71
rating table 71
Oldtown, Tenn.:
description 110
discharge 110

G.

Gaging stations, equipment of 15
location of, map showing 7
Greenbrier River at—
Alderson, W. Va.:
description 47
discharge 48
discharge, monthly 48
gage heights 48
rating table 48
Greeneville, Tenn.
Nolichucky River near:
description 83
discharge 83
discharge, monthly 85
gage heights 84
rating table 84
Grenada, Miss.,
Yalobusha River at:
description 113-114
discharge 114
gage heights 114
Grover, N. C., work in charge of 7

H.

Hall, M. R., work in charge of 7
Hall, O. P., work of 7
Hall, W. E., work of 7
Henshaw, F. F., work of 7
Hiwassee River at—
Murphy, N. C.:
description 97
discharge 97
discharge, monthly 99
gage heights 98
rating table 98
Reliance, Tenn.:
description 99
discharge 99
discharge, monthly 101
gage heights 100
rating table 100
Holston River at—
Austins Mills, Tenn.:
description 87
discharge 88
discharge, monthly 89
gage heights 88
rating table 88

Holston River (South Fork) at— Page.
Bluff City, Tenn.:
description 85
discharge 85
discharge, monthly 87
gage heights 86
rating table 86
Homochitto River at—
Rosetta, Miss.:
description 115
discharge 115
gage heights 115
Homochitto River basin:
description 114
stream data 115
horsepower computation of 11
Horseshoe, N. C.,
French Broad River at:
description 70
discharge 70
discharge, monthly 71
gage heights 71
rating table 71
Horton, A. H., work in charge of 7
Hoyt, J. C., work in charge of 7
Hydrographic surveys, organization and scope of 8

I.

Ice-covered streams, method of measuring flow of 19
Indianapolis, Ind.,
White River (West Branch) at:
description 66
discharge 66
discharge, monthly 68
gage heights 67
rating table 67

J.

Judson, N. C.,
Little Tennessee River at:
description 91
discharge 91
discharge, monthly 93
gage heights 92
rating table 92

K.

Kanawha River basin:
description of 45
stream data 46-48
Kentucky River at—
Frankfort, Ky.:
description 57
discharge 58
gage heights 58
Kentucky River basin:
description of 57
stream data 57-58
Kittanning, Pa.,
Allegheny River at:
description 30
discharge 31
discharge, monthly 32
gage heights 31
rating table 31

Page.

Knoxville, Tenn.,
Tennessee River near:
description 73
discharge 73
discharge, monthly 75
gage heights 74
rating table 74
Kriegsman, E. F., work of 7

L.

Laurel Hill Creek at—
Confluence, Pa.:
description 37
discharge 38
discharge, monthly 39
gage heights 38
rating table 38
Licking River at—
Pleasant Valley, Ohio:
description 43
discharge 43
discharge, monthly 45
gage heights 44
rating tables 44
Little Miami River at—
Loveland, Ohio:
description 51
discharge 51
gage heights 52
Little Miami River basin:
description of 51
stream data 51-54
Little Tennessee River at—
Almond, N. C.:
description 111
discharge 111
Judson, N. C.:
description 91
discharge 91
discharge, monthly 93
gage heights 92
rating table 92
McGhee, Tenn.:
description 93
discharge 93
discharge, monthly 95
gage heights 94
rating table 94
Logansport, Ind.,
Wabash River at:
description 60
discharge 60
discharge, monthly 61
gage heights 61
rating table 61
Loveland, Ohio.,
Little Miami River at:
description 51
discharge 51
gage heights 52
Lower eastern Mississippi drainages:
description 112
stream data 112-115

M.

Page.

McCays, Tenn.,
Fightingtown Creek at:
description 111-112
discharge 112
Ocoee River at:
description 104
discharge 104
discharge, monthly 105
gage heights 104
rating table 105
McGhee, Tenn.
Little Tennessee River at:
description 93
discharge 93
discharge, monthly 95
gage heights 94
rating table 94
Mad River near—
Springfield, Ohio:
description 52
discharge 52
discharge, monthly 54
gage heights 53
rating table 53
Mahoning River at—
Youngstown, Ohio:
description 39
discharge 40
discharge, monthly 41
gage heights 40
rating table 40
Miami River at—
Dayton, Ohio:
description 55
discharge 56
discharge, monthly 57
gage heights 56
rating table 57
Miami River basin:
description of 54-55
stream data 55-57
Mills River (North Fork) at—
Pinkbed, N. C.:
description 79
discharge 79
discharge, monthly 81
gage heights 80
rating table 80
Mills River (South Fork) near—
Sitton, N. C.:
description 81
discharge 81
discharge, monthly 83
gage heights 82
rating table 82
Miner's inch, definition of 10
Mississippi River basin (lower eastern):
description of 112
stream data 112-115
Monongahela River basin:
description of 33-34
stream data 34-39

Page.

Multiple-point method of measuring discharge, description of..... 17-18
Murphy, N. C.,
Hiwassee River at:
description..... 97
discharge..... 97
discharge, monthly..... 98
gage heights..... 98
rating table..... 99
Murray, F. A., work of..... 7
Muskingum River at—
Zanesville, Ohio:
description..... 41
discharge..... 41
discharge, monthly..... 43
gage heights..... 42
rating table..... 42
Muskingum River basin:
description of..... 41
stream data..... 41-45

N.

Nantahala River at—
Almond, N. C.:
description..... 111
discharge..... 111
New Haven, Ky.,
Salt River (Rolling Fork) at:
description..... 58
gage heights..... 59
Newport, Tenn.,
Pigeon River at:
description..... 110
discharge..... 111
New River at—
Radford, Va.:
description..... 46
discharge..... 46
discharge, monthly..... 47
gage heights..... 46
rating table..... 47
Nolichucky River near—
Greeneville, Tenn.:
description..... 83
discharge..... 83
discharge, monthly..... 85
gage heights..... 84
rating table..... 84
North Fork Mills River. *See* Mills River (North Fork).

O.

Ohio River at—
Wheeling, W. Va.:
description..... 25
discharge..... 26
discharge, monthly..... 27
gage heights..... 26
rating table..... 26
Ohio River basin:
description of..... 23-25
stream data..... 25-27
Ohio River drainage:
stream data..... 23-112

Page.

Okoee River at—
McCays, Tenn.:
description..... 104
discharge..... 104
discharge, monthly..... 105
gage heights..... 104
rating table..... 105
Oldtown, Tenn.,
French Broad River at:
description..... 110
discharge..... 110
Olentangy River near—
Columbus, Ohio:
description..... 50
discharge..... 50

P.

Padgett, H. D., work of..... 7
Paintrock River near—
Paintrock, Ala.:
description..... 112
discharge..... 112
Pigeon River at and near—
Newport, Tenn.:
description..... 110
discharge..... 111
Pinkbed, N. C.,
Mills River (North Fork) at:
description..... 79
discharge..... 79
discharge, monthly..... 81
gage heights..... 80
rating table..... 80
Pleasant Valley, Ohio,
Licking River at:
description..... 43
discharge..... 43
discharge, monthly..... 45
gage heights..... 44
rating tables..... 44
Price current meter, view of..... 16

R.

Radford, Va.,
New River at:
description..... 46
discharge..... 46
discharge, monthly..... 47
gage heights..... 46
rating table..... 47
Rating tables, construction of..... 19-20
Redhouse, N. Y.,
Allegheny River at:
description..... 28
discharge..... 29
discharge, monthly..... 30
gage heights..... 29
rating table..... 29
Reliance, Tenn.,
Hiawassee River at:
description..... 99
discharge..... 99
discharge, monthly..... 101
gage heights..... 100
rating table..... 100

Page.

Rolling Fork of Salt River. *See* Salt River (Rolling Fork).
Rosetta, Miss.,
Homochitto River at:
description..... 115
discharge..... 115
gage heights..... 115
Run-off, computation of..... 19-22
Run-off in inches, definition of..... 10

S.

Salt River (Rolling Fork) at—
New Haven, Ky.:
description..... 58
gage heights..... 29
Salt River basin:
description of..... 58
stream data..... 58-59
Scioto River near—
Columbus, Ohio:
description..... 49
discharge, monthly..... 50
gage heights..... 49
rating table..... 50
Scioto River basin:
description of..... 49
stream data..... 49-50
Second-feet per square mile, definition of... 10
Second-foot, definition of..... 10
Shoals, Ind.,
White River (East Branch) at:
description..... 68
discharge..... 69
discharge, monthly..... 69
gage heights..... 69
rating table..... 69
Single-point method of measuring discharge, description of..... 18
Sitton, N. C.,
Mills River (South Fork) near:
description of..... 81
discharge..... 81
discharge, monthly..... 83
gage heights..... 82
rating table..... 82
Slope method of measuring discharge, use and value of..... 14
South Fork Holston River. *See* Holston River (South Fork).
South Fork Mills River. *See* Mills River (South Fork).
Springfield, Ohio.,
Mad River near:
description..... 52
discharge..... 52
discharge, monthly..... 54
gage heights..... 53
rating table..... 53
Stewart, J. E., work of..... 7
Stream flow, measurement and computation of..... 13-22
papers on, list of..... 9
Surface water supply, papers on..... 8-9
Swannanoa River at—
Biltmore, N. C.:
description..... 110
discharge..... 110

T.

Page.

Tables, explanation of..... 10-11
Tallahatchie River at—
Batesville, Miss.:
description..... 113
discharge..... 113
gage heights..... 113
Tennessee River at and near—
Chattanooga, Tenn.:
description..... 75
discharge..... 75
discharge, monthly..... 77
gage heights..... 76
rating table..... 76
Knoxville, Tenn.:
description..... 73
discharge..... 73
discharge, monthly..... 75
gage heights..... 74
rating table..... 74
Tennessee River basin:
description of..... 70
miscellaneous measurements in..... 110-112
stream data..... 70-112
Terre Haute, Ind.,
Wabash River at:
description..... 62
discharge..... 62
discharge, monthly..... 63
gage heights..... 62
horsepower..... 63 64
rating table..... 63
Tippecanoe River near—
Delphi, Ind.:
description..... 64
discharge..... 64
discharge, monthly..... 65
gage heights..... 65
horsepower..... 66
rating table..... 65
Tomotla, N. C.,
Valley River at:
description..... 101
discharge..... 101
discharge, monthly..... 103
gage heights..... 102
rating table..... 103
Tuckasegee River at—
Bryson, N. C.:
description..... 95
discharge..... 95
discharge, monthly..... 97
gage heights..... 96
rating table..... 96

V.

Valley River at—
Tomotla, N. C.:
description..... 101
discharge..... 101
discharge, monthly..... 103
gage heights..... 102
rating table..... 103
Velocity method of measuring discharge, description of..... 15-19
Vertical-integration method of measuring discharge, description of..... 18
Vertical-velocity-curve method of measuring discharge, description of.... 17-18

W. Page.

Wabash River at—
Logansport, Ind.:
description 60
discharge 60
discharge, monthly 61
gage heights 61
rating table 61
Terre Haute, Ind.:
description 62
discharge 62
discharge, monthly 63
gage heights 62
horsepower 63-64
rating table 63
Wabash River basin:
description of 59-60
stream data 60-69
Watauga River near—
Elizabethton, Tenn.:
description 89
discharge 90
discharge, monthly 91
gage heights 90
rating table 90
Water power, computation of 11
Water supply, surface, papers on 8-9
Weir method of measuring discharge, requirements of 14-15
West Branch of White River. *See* White River (West Branch.)
Wheeling, W. Va.,
Ohio River at:
description 25
discharge 26
discharge, monthly 27
gage heights 26
rating table 26
White River (East Branch) at—
Shoals, Ind.:
description 68
discharge 69
discharge, monthly 69
White River (East Branch) at— Page.
Shoals, Ind.:
gage heights 69
rating table 69
White River (West Branch) at—
Indianapolis, Ind.:
description 66
discharge 66
discharge, monthly 68
gage heights 67
rating table 67

Y.

Yalobusha River at—
Grenada, Miss.:
description 113-114
discharge 114
gage heights 114
Yazoo River basin:
description 112
stream data 113-114
Youghiogheny River near—
Confluence, Pa.:
description 34
discharge 34
discharge, monthly 35
gage heights 34
rating table 35
Youngstown, Ohio.,
Mahoning River at:
description 39
discharge 40
discharge, monthly 41
gage heights 40
rating table 40

Z.

Zanesville, Ohio.
Muskingum River at:
description 41
discharge 41
discharge, monthly 43
gage heights 42
rating table 42

CLASSIFICATION OF THE PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

[Water-Supply Paper No. 205.]

The publications of the United States Geological Survey consist of (1) Annual Reports; (2) Monographs; (3) Professional Papers; (4) Bulletins; (5) Mineral Resources; (6) Water-Supply and Irrigation Papers; (7) Topographic Atlas of United States, folios and separate sheets thereof; (8) Geologic Atlas of United States, folios thereof. The classes numbered 2, 7, and 8 are sold at cost of publication; the others are distributed free. A circular giving complete lists can be had on application.

Most of the above publications can be obtained or consulted in the following ways:

1. A limited number are delivered to the Director of the Survey, from whom they can be obtained, free of charge (except classes 2, 7, and 8), on application.

2. A certain number are delivered to Senators and Representatives in Congress, for distribution.

3. Other copies are deposited with the Superintendent of Documents, Washington, D. C., from whom they can be had at practically cost.

4. Copies of all Government publications are furnished to the principal public libraries in the large cities throughout the United States, where they can be consulted by those interested.

The Professional Papers, Bulletins, and Water-Supply Papers treat of a variety of subjects, and the total number issued is large. They have therefore been classified into the following series: A, Economic geology; B, Descriptive geology; C, Systematic geology and paleontology; D, Petrography and mineralogy; E, Chemistry and physics; F, Geography; G, Miscellaneous; H, Forestry; I, Irrigation; J, Water storage; K, Pumping water; L, Quality of water; M, General hydrographic investigations; N, Water power; O, Underground waters; P, Hydrographic progress reports.

Series P.—The hydrographic progress reports contain the results of stream measurements. A report is issued for every calendar year, containing the results of data collected during that year. These reports were first published as a part of the Director's annual report or as a bulletin; they are now published as water-supply and irrigation papers. The following is a list, by years, of the publications containing the progress reports of stream measurements (* means out of stock). A detailed index of these reports (1888-1903) is published as Water-Supply Paper No. 119.

1888. Tenth Annual Report, Part II*.
1889. Eleventh Annual Report, Part II*.
1890. Twelfth Annual Report, Part II*.
1891. Thirteenth Annual Report, Part III*.
1892. Fourteenth Annual Report, Part II*.
1893. Bulletin No. 131*.
1894. Bulletin No. 131*; Sixteenth Annual Report, Part II*.
1895. Bulletin No. 140*.
1896. Water-Supply Paper No. 11*; Eighteenth Annual Report, Part IV*.
1897. Water-Supply Papers Nos. 15* and 16*; Nineteenth Annual Report, Part IV*.
1898. Water-Supply Papers Nos. 27* and 28*; Twentieth Annual Report, Part IV*.
1899. Water-Supply Papers Nos. 35*, 36*, 37*, 38*, and 39*; Twenty-first Annual Report, Part IV*.
1900. Water-Supply Papers Nos. 47, 48, 49, 50, 51, and 52; Twenty-second Annual Report, Part IV.
1901. East of Mississippi River, Water-Supply Papers Nos. 65* and 75*.
West of Mississippi River, Water-Supply Papers Nos. 66 and 75*.

1902. East of Mississippi River, Water-Supply Papers Nos. 82 and 83.
West of Mississippi River, Water-Supply Papers Nos. 84 and 85.
1903. East of Mississippi River, Water-Supply Papers Nos. 97 and 98.
West of Mississippi River, Water-Supply Papers Nos. 99 and 100.
1904. East of Mississippi River, Water-Supply Papers Nos. 124, 125, 126, 127, 128, and 129.
West of Mississippi River, Water-Supply Papers Nos. 130, 131, 132, 133, 134, and 135.
1905. East of Mississippi River, Nos. 165*, 166*, 167, 168*, 169, 170, and 171.
West of Mississippi River, Nos. 171, 172*, 173*, 174, 175*, 176, 177, and 178.
1906. East of Mississippi River, Nos. 201, 202, 203, 204, 205, 206, and 207.
West of Mississippi River, Nos. 207, 208, 209, 210, 211, 212, 213, and 214.

Correspondence should be addressed to

THE DIRECTOR,
UNITED STATES GEOLOGICAL SURVEY,
WASHINGTON, D. C.

JULY, 1907.

O

Water-Supply and Irrigation Paper No. 206 Series P, Hydrographic Progress Reports, 60

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

SURFACE WATER SUPPLY

OF

GREAT LAKES AND ST. LAWRENCE RIVER DRAINAGES, 1906

H. K. BARROWS
A. H. HORTON
DISTRICT HYDROGRAPHERS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1907

CONTENTS.

	Page.
Introduction	1
Scope of work	1
Definitions	3
Explanation and use of tables	4
Convenient equivalents	6
Field methods of measuring stream flow	7
Office methods of computing run-off	13
Cooperation and acknowledgments	16
Lake Michigan drainage	16
General features	16
Escanaba River basin	17
Escanaba River near Escanaba, Mich	17
Menominee River basin	18
Menominee River near Iron Mountain, Mich	18
Peshtigo River drainage basin	20
Description of basin	20
Peshtigo River survey	20
Peshtigo River at Crivitz, Wis	20
Peshtigo River at Herman's farm, near Crivitz, Wis	21
Oconto River drainage basin	23
Description of basin	23
Oconto River at Gillett, Wis	23
Oconto River at Stiles, Wis	24
Wolf River basin	24
Description of basin	24
Wolf River at Darrow's bridge, near Shawano, Wis	25
Wolf River at White House bridge, near Shawano, Wis	25
St. Joseph River basin	26
Description of basin	26
St. Joseph River at Mendon, Mich	27
St. Joseph River near Buchanan, Mich	27
Kalamazoo River basin	28
Description of basin	28
Kalamazoo River near Allegan, Mich	29
Reeds Springs, near Albion, Mich	30
Grand River basin	30
Description of basin	30
Grand River, North Lansing, Mich	30
Grand River at Grand Rapids, Mich	32
Muskegon River basin	33
Description of basin	33
Muskegon River at Newaygo, Mich	34

Lake Michigan drainage—Continued. Page.
Manistee River basin 35
Description of basin 35
Manistee River, near Sherman, Mich 35
Lake Huron drainage 36
General features 36
Au Sable River basin 36
Description of basin 36
Au Sable River at Bamfield, Mich 36
Rifle River basin 38
Description of basin 38
Rifle River, near Sterling, Mich 38
Saginaw River basin 39
Description of basin 39
Tittabawassee River at Freeland, Mich 39
Lake Erie drainage 40
General features 40
Huron River basin 41
Description of basin 41
Huron River at Dexter, Mich 41
Huron River at Geddes, Mich 42
Huron River at Flatrock, Mich 42
Maumee River basin 44
Description of basin 44
Maumee River near Sherwood, Ohio 44
St. Joseph River at Fort Wayne, Ind 46
St. Marys River at Fort Wayne, Ind 47
Tiffin River near Defiance, Ohio 49
Black River basin 50
Black River near Elyria, Ohio 50
Cuyahoga River basin 53
Description of basin 53
Cuyahoga River at Independence, Ohio 53
Lake Ontario drainage 54
General features 54
Genessee River basin 54
Description of basin 54
Genessee River and Canaserago Creek near Mount Morris, N. Y 56
Genessee River at High Dam, near Mount Morris, N. Y 57
Genessee River at Rochester, N. Y 58
Canadice Lake outlet near Hemlock, N. Y 60
Honeoyo Creek at East Rush, N. Y 61
Oswego River basin 62
Description of basin 62
Oswego River at Battle Island, N. Y 62
Canandaigua outlet at Alloway, N. Y 63
Seneca Lake at Geneva, N. Y 64
Cayuga Lake at Ithaca, N. Y 66
Seneca River at Baldwinsville, N. Y 66
Skaneateles Lake outlet at Willow Glen, N. Y 67
Oneida River near Euclid, N. Y 69
Oneida Creek at Kenwood, N. Y 70
Chittenango Creek at Chittenango, N. Y 71

Lake Ontario drainage—Continued. Page.
Salmon River basin 72
Description of basin 72
Salmon River near Pulaski, N. Y 73
Black River basin 75
Description of basin 75
Black River near Felts Mills, N. Y 75
Moose River at Moose River, N. Y 76
St. Lawrence River drainage 78
General features 78
Oswegatchie River basin 78
Description of basin 78
Oswegatchie River near Ogdensburg, N. Y 79
Raquette River basin 81
Description of basin 81
Raquette River at Massena Springs, N. Y 82
Lake Champlain drainage basin 84
Description of basin 84
Richelieu River at Fort Montgomery, N. Y 84
Saranac River near Plattsburg, N. Y 86
Otter Creek at Middlebury, Vt 87
Winooski River at Richmond, Vt 89

ILLUSTRATIONS.

Page.

PLATE I. Map of United States showing location of principal river stations maintained during 1908 2

II. *A*, Current-meter rating station, Los Angeles, Cal.; *B*, Price-current meters 10

III. Falls on Peshtigo River, Wis.; *A*, High Falls (40-foot fall); *B*, Caldron Falls (55-foot fall) 20

FIG. 1. Cable station, showing section of river, car, gage, etc 11

2. Typical discharge, area, and mean-velocity curves 15

SURFACE WATER SUPPLY OF THE GREAT LAKES AND ST. LAWRENCE RIVER DRAINAGES, 1906.[a]

H. K. BARROWS and A. H. HORTON,
District Hydrographers.[b]

INTRODUCTION.

SCOPE OF WORK.

The water supply of the United States is of more importance to the life and pursuits of the people than is any other natural resource. In the arid States the limit of agricultural development is determined by the amount of water available for irrigation; while in all parts of the country the increase in the population of cities and towns makes necessary additional water supplies for domestic and industrial uses, in procuring which both the quantity and the quality of the water that may be obtained must be considered. The location of manufacturing plants may depend largely on the water-power facilities and on the character of the water. The notable advances made in the electric transmission of power have led to the utilization of water powers for the operation of manufacturing establishments, railroads, and municipal lighting plants, many of which are at some distance from the places at which the power is developed.

The intelligent establishment and maintenance of enterprises or industries that depend on the use of water demands a thorough knowledge of the flow of the streams and an understanding of the conditions affecting that flow. This knowledge should be based on data showing both the total flow and the distribution of the flow throughout the year, in order that normal fluctuations may be provided for. As the flow of a stream is variable from year to year, estimates of future flow can be made only from a study of observations

[a] This report contains information similar to that published in previous years under the title "Report on Progress of Stream Measurements."

[b] The data presented in this report were collected as follows:

New York and New England under the direction of H. K. Barrows, assisted by Robert E. Horton and C. C. Covert.

Michigan and Wisconsin, A. H. Horton, district hydrographer, assisted by M. S. Brennan, L. S. Smith, V. H. Reineking, and D. H. Dugan.

The preparation of the data for publication has been under the direction of John C. Hoyt, assisted by R. H. Bolster, Robert Follansbee, F. F. Henshaw, J. E. Stewart, and H. D. Padgett.

covering several years. The rapid increase in the development c water resources of the United States has caused a great deman engineers for information in regard to the flow of streams, as it is generally realized that the failure of many large power, irrigation other projects has been due to the fact that the plans were without sufficient trustworthy information in respect to the supply.

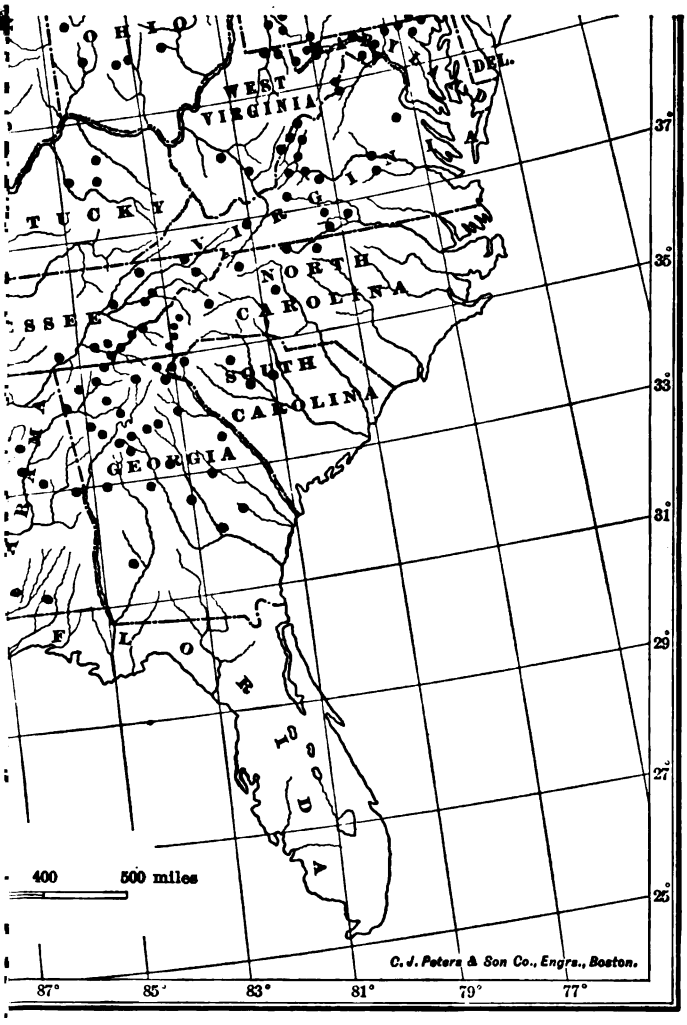
Owing to the broad scope of these hydrographic investigation the length of time they should cover in order that the records m of greatest value, it is in general impossible for private individu collect the necessary data, and as many of the streams traverse than one State this work does not properly fall within the pr of the State authorities. The United States Geological Surve therefore, by means of specific appropriations by Congress, for s years systematically made records of stream flow, with the vi ultimately determining all the important features governing th of the principal streams of the country. In carrying out thi stations are established on the streams and maintained for a long enough to show their regimen or general behavior. W record that is sufficient for this purpose has been obtained fo stream the work on that stream is discontinued. The order in the streams are measured is determined by the degree of their i tance.

During 1906 the regimen of flow was studied at about 700 st distributed along the various rivers throughout the United Stat shown on Pl. I. In addition to these records data in regard t cipitation, evaporation, water power, and river profiles were ob in many sections of the country.

These data have been assembled by drainage areas, and are lished in a series of fourteen Water-Supply and Irrigation P Nos. 201 to 214, inclusive, each of which pertains to the surface resources of a group of adjacent areas. In these papers are embo not only the data collected in the field, but also the results of co tations based on these data, and other information that has a d bearing on the subject, such as descriptions of basins and the str draining them, utility of the water resources, etc. The list foll

Water-Supply and Irrigation Papers on Surface Water Supply, 1906.

201. Surface water supply of New England, 1906 (Atlantic Coast of New En drainage).
202. Surface water supply of the Hudson, Passaic, Raritan, and Delaware river ages, 1906.
203. Surface water supply of the Middle Atlantic States, 1906. (Susquehanna, powder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainag
204. Surface water supply of the Southern Atlantic and Eastern Gulf States, (Santee, Savannah, Ogeechee, and Altamaha rivers and eastern Gulf of M drainages.)


WEST VIRGINIA
DEL.
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
FLORIDA
400 500 miles
C. J. Peters & Son Co., Engrs., Boston.
37°
35°
33°
31°
29°
27°
25°
87°
85°
83°
81°
79°
77°

ING 1906.

205. Surface water supply of the Ohio and lower eastern Mississippi river drainages, 1906.
206. Surface water supply of the Great Lakes and St. Lawrence River drainages, 1906.
207. Surface water supply of the upper Mississippi River and Hudson Bay drainage, 1906.
208. Surface water supply of the Missouri River drainage, 1906.
209. Surface water supply of the lower western Mississippi River drainage, 1906.
210. Surface water supply of the western Gulf of Mexico and Rio Grande drainages, 1906.
211. Surface water supply of the Colorado River drainage above Yuma, 1906.
212. Surface water supply of the Great Basin drainage, 1906.
213. Surface water supply of California, 1906. (The Great Basin and Pacific Ocean drainage in California, and Colorado River drainage below Yuma.)
214. Surface water supply of the North Pacific Coast drainages, 1906.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing such records up to and including 1903 has been published in Water-Supply Paper No. 119. The following table gives, by years and primary drainage basins, the numbers of the papers on the surface water supply, published from 1901 to 1906.

Numbers of water-supply papers containing results of stream measurements, 1901–1906.[a]

	1901.	1902.	1903.	1904.	1905.	1906.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
Atlantic Coast of New England drainage	65 75	82	97	124	165	201
Hudson, Passaic, Raritan, and Delaware river drainages	65 75	82	97	125	166	202
Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages	65 75	82 83	97 98	126	167	203
Santee, Savannah, Ogeechee, and Altamaha river and eastern Gulf of Mexico drainages	65 75	83	98	126	168	204
Ohio and lower eastern Mississippi river drainages	65 75	83	98	128	169	205
Great Lakes and St. Lawrence River drainages	65	83	97	129	170	206
Hudson Bay and upper eastern and western Mississippi River drainages	65 66 75	83 84 85	98 99 100	128 130	171	207
Missouri River drainage	66 75	84	99	130 131	172	208
Meramec, Arkansas, Red, and lower western Mississippi river drainages	66 75	84	99	131	173	209
Western Gulf of Mexico and Rio Grande drainages	66 75	84	99	132	174	210
Colorado River drainage above Yuma	66 75	85	100	133	175	211
The Great Basin drainage	66 75	85	100	133	175	211
The Great Basin and Pacific Ocean drainages in California and Colorado River drainage below Yuma	66 75	85	100	134	177	213
North Pacific Coast drainages	66 75	85	100	135	178	214

DEFINITIONS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups—(1) those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet

[a] Reports containing data for years prior to 1901 are noted in the series list at the end of this paper.

per square mile, and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the quantity of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the quantity of water that passes through an orifice 1 inch square under a head which varies locally. It has been commonly used by miners and irrigators throughout the West and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

"Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work. There is a convenient relation between the second-foot and the acre-foot: One second-foot flowing for twenty-four hours will deliver 86,400 cubic feet, or approximately 2 acre-feet.

EXPLANATION AND USE OF TABLES.

For each regular gaging station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of monthly and yearly discharges and run-off.
6. Tables showing discharge and horsepower and the number of days during the year when the same are available.

The descriptions of stations give such general information about the locality and equipment as would enable the reader to find and use the station, and they also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge-measurement table gives the results of the discharge

measurements made during the year, including the date, the name of the hydrographer, the width and area of cross section, the gage height, and the discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage heights taken each day. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. At most stations the gage is read in the morning and in the evening.

The discharge measurements and gage heights are the base data from which the other tables are computed. In cases of extensive development, it is expected that engineers will use these original data in making their calculations, as the computations made by the Survey are based on the data available at the time they are made and should be reviewed and, if necessary, revised when additional data are available.

The rating table gives the discharge in second-feet, corresponding to various stages of the river, as given by the gage heights. It is published to enable engineers to determine the daily discharge in case this information is desired.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise, in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow for each second during the month. Upon this the computations for the remaining columns, which are defined on page 4, are based.

The values in the table of monthly discharge are intended to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates.

In most work where data in regard to flow are used the regimen of flow is of primary importance. Therefore for the principal stations tables have been prepared showing the horsepower that can be developed at various rates of flow and the length of time that these rates of flow and the corresponding horsepower are available. These tables have been prepared on a basis of 80 per cent efficiency on the turbines, and the horsepower per foot of fall is given in order that the reader can determine the horsepower for any fall.

In the computations sufficient significant figures have been used so that the percentage of error in the tables will not in general exceed 1 per cent. Therefore most of the values in the tables are given to

only three significant figures. In making the various computations Thatcher's slide rule, Crelle's tables, and computation machines have been generally used.

In order to give engineers an idea of the relative value of the various data, notes in regard to accuracy are given as far as possible. This accuracy depends on the general local conditions at the gaging stations and the amount of data collected. Every effort possible is made to so locate the stations that the data collected will give a high degree of accuracy. This is not always possible, but it is considered better to publish rough values with explanatory notes rather than no data.

In the accuracy notes the following terms have been used, indicating the probable accuracy in per cent of the mean monthly flow. As these values are mean values, the error in the value for the flow of any individual day may be much larger.

Excellent indicates that the mean monthly flow is probably accurate to within 5 per cent; good, to within 10 per cent; fair, to within 15 per cent; approximate, to within 25 per cent.

CONVENIENT EQUIVALENTS.

Following is a table of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second-foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equal 15.7 United States gallons per second.
100 California miner's inches equal 96.0 Colorado miner's inches.
100 California miner's inches for one day equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 104 California miner's inches.
100 Colorado miner's inches for one day equal 5.17 acre-feet.
100 United States gallons per minute equal 0.223 second-foot.

100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1½ horsepower equal about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel, realizing 80 per cent of theoretical power.

FIELD METHODS OF MEASURING STREAM FLOW.

The methods used in collecting these data and in preparing them for publication are given in detail in Water-Supply Papers No. 94 (Hydrographic Manual, U. S. Geological Survey) and No. 95 (Accuracy of Stream Measurements). In order that those who use this report may readily become acquainted with the general methods employed, the following brief descriptions are given:

Streams may be divided, with respect to their physical conditions, into three classes—(1) those with permanent beds; (2) those with beds which change only during extreme low or high water; (3) those with constantly shifting beds. In determining the daily flow special methods are necessary for each class. The data upon which these determinations are based and the methods of collecting them are, however, in general the same.

There are three distinct methods of determining the flow of open-channel streams—(1) by measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir; (3) by measurements of the velocity of the current and the area of the cross section. The method chosen for any case depends upon the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to

the coefficients to be used in the Chezy formula, $v = c\sqrt{Rs}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The results obtained by the slope method are, in general, only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for n to be used in Kutter's formula. The most common use of this method is in determining the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions.

Weir methods.—When funds are available and the conditions are such that sharp-crested weirs can be erected, these offer the best facilities for determining the flow. If dams are suitably situated and constructed, they may be utilized for obtaining reliable measurements of flow. The conditions necessary to insure good results may be divided into two classes—(1) those relating to the physical characteristics of the dam itself and (2) those relating to the diversion and use of water around and through the dam.

The physical requirements are as follows: (*a*) Sufficient height of dam, so that backwater will not interfere with free fall over it; (*b*) absence of leaks of appreciable magnitude; (*c*) topography or abutments which confine the flow over the dam at high stages; (*d*) level crests, which are kept free from obstructions caused by floating logs or ice; (*e*) crests of a type for which the coefficients to be used in $Q = c\,b\,h^{\frac{3}{2}}$, or some similar standard weir formula are known (see Water-Supply Papers Nos. 180 and 200[a]); (*f*) either no flash boards or exceptional care in reducing leakage through them and in recording their condition.

Preferably there should be no diversion of water through or around the dam. Generally, however, the dam is built for purposes of power or navigation and part or all of the water flowing past it is diverted for such uses. This water is measured and added to that passing over the dam. To insure accuracy in such determinations of flow the amount of water diverted should be reasonably constant. Furthermore, it should be so diverted that it can be measured, either by a weir, a current meter, or a simple system of water wheels which are of standard make, or which have been rated as meters under working conditions, and so installed that the gate openings, the heads under which they work, and their angular velocities may be accurately observed.

The combination of physical conditions and uses of the water should be such that the determinations of flow will not involve, for a critical stage of considerable duration, the use of a head, on a broad-

[a] Water-Supply Paper No. 200 replaces No. 150, the edition of which has been exhausted.

crested dam, of less than 6 inches. Moreover, when all other conditions are good, the cooperation of the owners or operators of the plant is still essential if reliable results are to be obtained.

A gaging station at a weir or dam has the general advantage of continuity of record through the period of ice and floods and the disadvantages of uncertainty of coefficient to be used in the weir formula and of complications in the diversion and use of the water.

Velocity method.—The determination of the quantity of water flowing past a certain section of a stream at a given time is termed a discharge measurement. This quantity is the product of two factors—the mean velocity and the area of the cross section. The mean velocity is a function of surface slope, wetted perimeter, roughness of bed, and the channel conditions at, above, and below the gaging section. The area depends upon the contour of the bed and the fluctuations of the water surface. The two principal ways of measuring the velocity of a stream are by floats and current meters.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements in order that the data may have the required degree of accuracy. Their essential requirements are practically the same whether the velocity is determined by meters or floats. They are located as far as possible where the channel is straight both above and below the gaging section; where there are no cross currents, backwater, or boils; where the bed of the stream is reasonably free from large projections of a permanent character; and where the banks are high and subject to overflow only at flood stages. The station must be so far removed from the effects of tributary streams and of dams or other artificial obstructions that the gage height shall be an index of the discharge.

Certain permanent or semipermanent structures usually referred to as equipment are generally pertinent to a gaging station. These are a gage for determining the fluctuations of the water surface, bench marks to which the datum of the gage is referred, permanent marks on a bridge or a tagged line indicating the points of measurement, and, where the current is swift, some appliance (generally a secondary cable) to hold the meter in position in the water. As a rule, the stations are located at bridges if the channel conditions are satisfactory, as from them the observations can more readily be made and the cost of the equipment is small.

The floats in common use are the surface, subsurface, and tube or rod floats. A corked bottle with a flag in the top and weighted at the bottom makes one of the most satisfactory surface floats, as it is affected but little by wind. In case of flood measurements, good results can be obtained by observing the velocity of floating cakes of ice or débris. In case of all surface-float measurements, coefficients must be used to reduce the observed velocity to the mean velocity,

The subsurface and tube or rod floats are intended to give directly the mean velocity in the vertical. Tubes give excellent results when the channel conditions are good, as in canals.

In measuring velocity by a float, observation is made of the time taken by the float to pass over the "run," a selected stretch of river from 50 to 200 feet long. In each discharge measurement a large number of velocity determinations are made at different points across the stream, and from these observations the mean velocity for the whole section is determined. This may be done by plotting the mean positions of the floats as indicated by the distances from the bank as ordinates and the corresponding times as abscissas. A curve through these points shows the mean time of run at any point across the stream, and the mean time for the whole stream is obtained by dividing the area bounded by this curve and its axis by the width. The length of the run divided by the mean time gives the mean velocity.

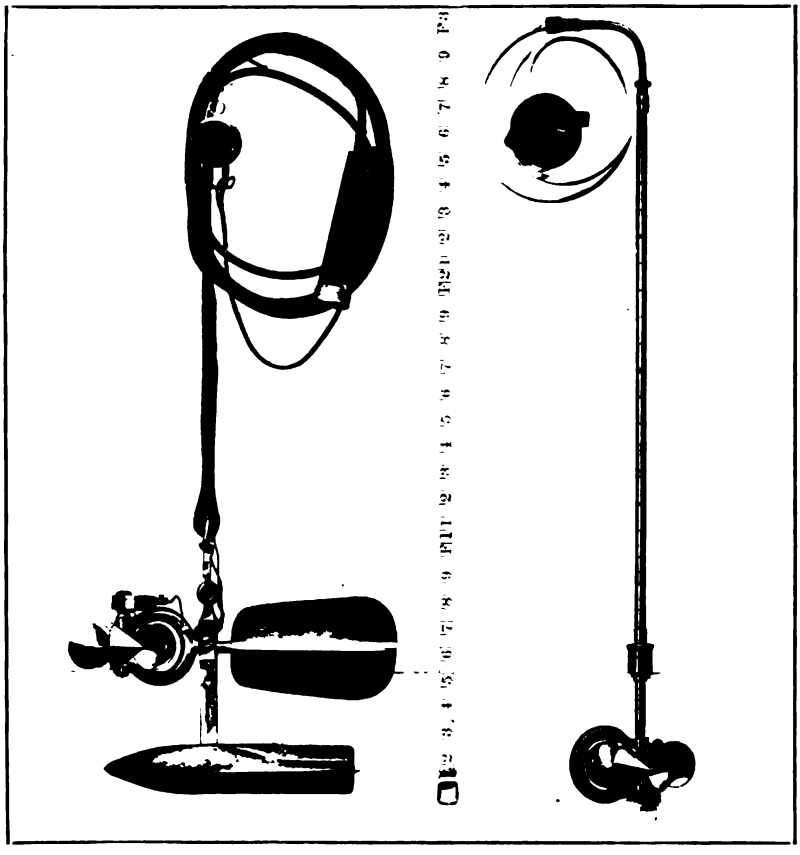
The area used in float measurements is the mean of the areas at the two ends of the run and at several intermediate sections.

The essential parts of the current meters in use are a wheel of some type, so constructed that the impact of flowing water causes it to revolve, and a device for recording or indicating the number of revolutions. The relation between the velocity of the moving water and the revolutions of the wheel is determined for each meter. This rating is done by drawing the meter through still water for a given distance at different speeds and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity per second for any number of revolutions.

Many kinds of current meters have been constructed. They may, however, be classed in two general types: Those in which the wheel is made up of a series of cups, as the Price, and those having a screw propeller wheel, as the Haskell. Each meter has been developed for use under some special condition. In the case of the small Price meter, shown in Pl. II, *A*, which has been largely developed and has been extensively used by the United States Geological Survey, an attempt has been made to get an instrument which could be used under practically all conditions.

Current-meter measurements may be made from a bridge, a cable, a boat, or by wading, and gaging stations may be classified in accordance with such use. Fig. 1 shows a typical cable station.

In making the measurement an arbitrary number of points are laid off on a line perpendicular to the thread of the stream. The points at which the velocity and depth are observed are known as measuring points, and are usually fixed at regular intervals, varying from 2 to 20 feet, depending upon the size and condition of the stream. Perpendiculars dropped from the measuring points divide the gaging section into strips. For each strip or pair of strips the mean velocity,



A. PRICE CURRENT METERS.

B. CURRENT-METER RATING STATION AT LOS ANGELES, CAL.

area, and discharge are determined independently, so that conditions existing in one part of the stream may not be extended to parts where they do not apply.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

The three principal multiple-point methods in general use are the vertical velocity-curve; 0.2 and 0.8 depth; and top, bottom, and mid-depth.

In the vertical velocity-curve method a series of velocity determinations are made in each vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve among the resulting points, the vertical velocity-curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity-curve and its axis by the depth. On account of the length

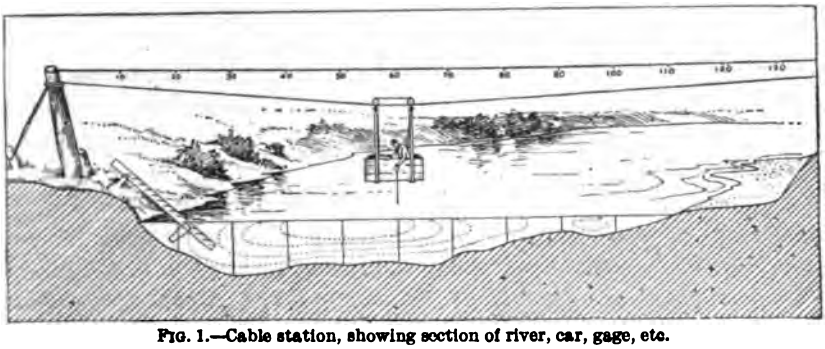


FIG. 1.—Cable station, showing section of river, car, gage, etc.

of time required to make a complete measurement by this method, its use is limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 of the depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 of the depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this second multiple-point method gives the mean velocity very closely for open-water conditions and, moreover, the indications are that it holds nearly as well for ice-covered rivers.

In the third multiple-point method the meter is held at mid-depth, at 0.5 foot below the surface, and at 0.5 foot above the bottom, and the mean velocity is determined by dividing by 6 the sum of the top

velocity, four times the mid-depth velocity, and the bottom velocity. This method may be modified by observing at 0.2, 0.6, and 0.8 depth.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined.

Extensive experiments by vertical velocity-curves show that the thread of mean velocity generally occurs at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, at which point the meter is held in a majority of the measurements. A large number of vertical velocity-curve measurements taken on many streams and under varying conditions show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be from 0.85 to 0.95, depending upon the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is especially adapted for flood measurements, or when the velocity is so great that the meter can not be kept at 0.6 depth.

The vertical-integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface, and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods.

The area, which is the other factor in the velocity method of determining the discharge of a stream, depends on the stage of the river, which is observed on the gage, and on the general contour of the bed of the stream, which is determined by soundings. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable or by a special sounding line or rod. For streams with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also of value in obtaining the area for use in computations of high-water measurements, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at various points of measurement, the measuring section is divided into elementary strips, as shown in fig. 1, and the

mean velocity, area, and discharge are determined separately for either a single or a double strip. The total discharge and the area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period, and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8, and vertical velocity-curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, the thickness and character of the ice, etc. From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice. For information in regard to flow under ice cover, see Water-Supply Paper No. 187.

OFFICE METHODS OF COMPUTING RUN-OFF.

There are two principal methods of determining run-off, depending upon whether or not the bed of the stream is permanent.

For stations on streams with permanent beds, the first step in computing the run-off is the construction of a rating table, which shows the discharge corresponding to any stage of the stream. This rating table is applied to the record of stage to determine the amount of water flowing. The construction of the rating table depends upon the method used in measuring flow.

For a station at a weir or dam, the basis for the rating table is some standard weir formula. The coefficients to be used in its application depend upon the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and assumed coefficient, the discharge is computed for various heads and the rating table constructed.

The data necessary for the construction of a rating table for a velocity-area station are the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross section, the mean velocity of the current, and the quantity of water flowing. A thorough knowledge of the conditions at and in the vicinity of the station is also necessary.

The construction of the rating table depends upon the following laws of flow for open, permanent channels: (1) The discharge will remain constant so long as conditions at or near the gaging station remain constant; (2) the discharge will be the same whenever the stream is at a given stage if the change of slope due to the rise and fall

of the stream be neglected; (3) the discharge is a function of and increases gradually with the stage.

The plotting of results of the various discharge measurements, using gage heights as ordinates, and discharge, mean velocity, and area as abscissas, will define curves which show the discharge, mean velocity, and area corresponding to any gage height. For the development of these curves there should be therefore a sufficient number of discharge measurements to cover the range of the stage of the stream. Fig. 2 shows a typical rating curve with its corresponding mean-velocity and area curves.

As the discharge is the product of two factors—the area and the mean velocity—any change in either factor will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is always concave toward the horizontal axis or on a straight line, unless the banks of the stream are overhanging.

The form of the mean-velocity curve depends chiefly upon the surface slope, the roughness of the bed, and the cross section of the stream. Of these the slope is the principal factor. In accordance with the relative changes of these factors the curve may be either a straight line, convex or concave toward either axis, or a combination of the three. From a careful study of the conditions at any gaging station the form which the vertical velocity-curve will take can be predicted, and it may be extended with reasonable certainty to stages beyond the limits of actual measurements. Its principal use is in connection with the area curve in locating errors in discharge measurements and in constructing the rating table.

The discharge curve is defined primarily by the measurements of discharge, which are studied and weighted in accordance with the local conditions existing at the time of each measurement. The curve may, however, best be located between and beyond the measurements by means of curves of area and mean velocity. The discharge curve under normal conditions is concave toward the horizontal axis and is generally parabolic in form.

In the preparation of the rating table the discharge for each tenth or half tenth on the gage is taken from the curve. The differences between successive discharges are then taken and adjusted according to the law that they shall either be constant or increasing.

The determination of daily discharge of streams with changeable beds is a difficult problem. In case there is a weir or dam available, a condition which seldom exists on streams of this class, the discharge can be determined by its use. In case of velocity-area stations frequent discharge measurements must be made if the deter-

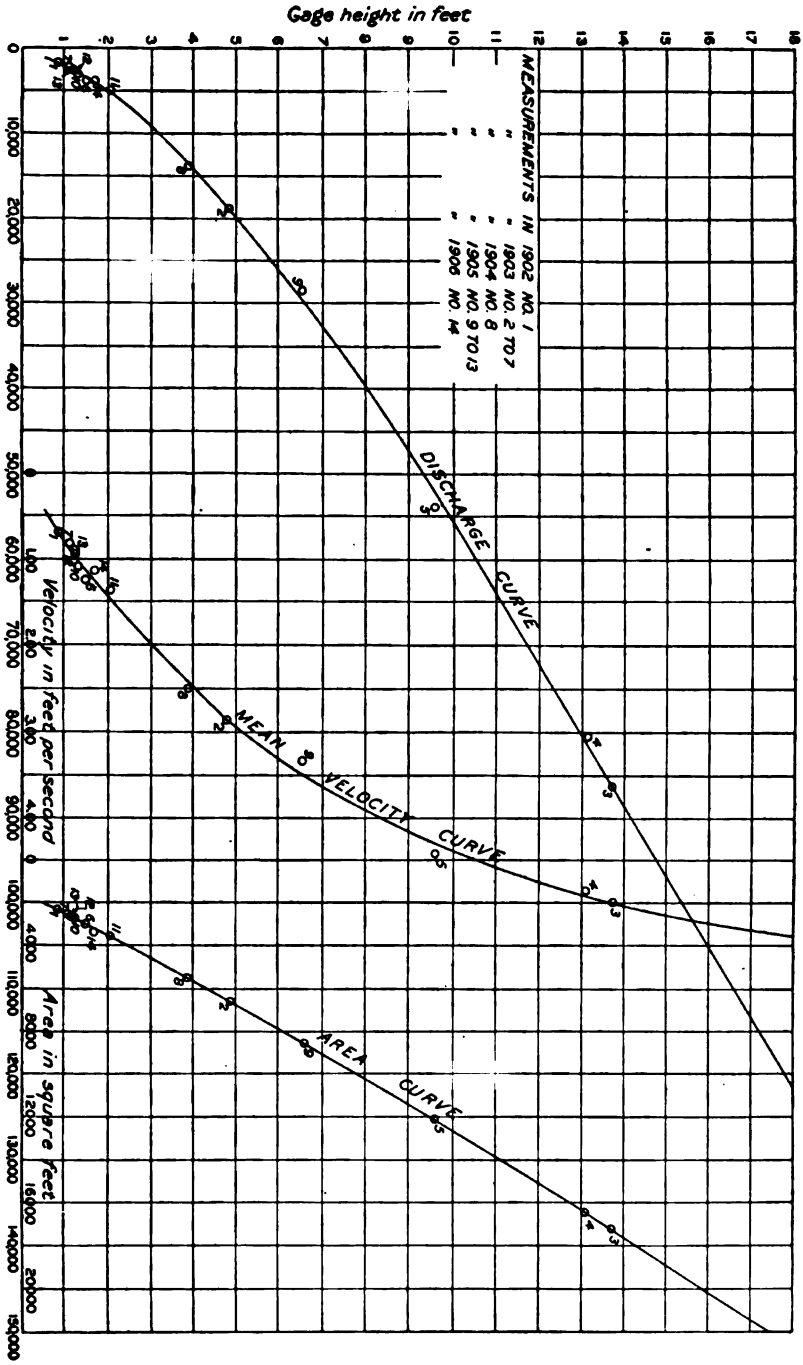


FIG. 2.—Discharge, area, and mean-velocity curves of Potomac River at Point of Rocks, Md.

minations of flow are to be other than rough approximations. For stations with beds which shift slowly or are materially changed only during floods, rating tables can be prepared for periods between such changes and satisfactory results obtained with a limited number of measurements, provided that some of them are taken soon after the change occurs. For streams with continually shifting beds, such as the Colorado and Rio Grande, discharge measurements should be made every two or three days and the discharge for intervening days obtained either by interpolation modified by gage height or by Professor Stout's method, which has been described in full in the Nineteenth Annual Report of the United States Geological Survey, Part IV, page 323, and in the Engineering News of April 21, 1904. This method, or a graphical application of it, is also much used in determining the flow at stations where the bed shifts but slowly.

COOPERATION AND ACKNOWLEDGMENTS.

Assistance has been rendered and records furnished by the following, to whom special acknowledgment is due:

H. C. Allen, special deputy State engineer, E. A. Fisher, city engineer, and J. F. Skinner, special assistant engineer, Rochester, N. Y.; Utica Consolidated Paper Company, Utica, N. Y.; A. T. Safford, consulting engineer, International Paper Company, Corinth, N. Y.; R. P. Bloss, engineer, West Virginia Pulp and Paper Company, Mechanicsville, N. Y.; G. H. Beebe, deputy city engineer, Syracuse, N. Y.; Mount Morris Paper Company, Mount Morris, N. Y.; Utica Gas and Electric Light Company; Albany and Hudson River Railroad Company; J. Waldo Smith, chief engineer, and Carlton E. Davis, resident engineer, New York Additional Water Supply Commission; Kalamazoo Valley Electric Company, Kalamazoo, Mich.; Flint Land Company, Flint, Mich.; Fletcher Paper Company, Alpena, Mich.; L. W. Anderson, city engineer, Grand Rapids, Mich.; Washtenaw Electric Company, Ann Arbor, Mich.; Gardner S. Williams, Ann Arbor, Mich.; W. E. Denison, Freeland, Mich.; Cheboygan Electric Light and Power Company, Cheboygan, Mich.; Wisconsin Geological and Natural History Survey, Dr. E. A. Birge, superintendent; and D. W. Mead, Madison, Wis.

LAKE MICHIGAN DRAINAGE.

GENERAL FEATURES.

The Lake Michigan drainage basin comprises a comparatively narrow strip of flat or gently rolling land in eastern Wisconsin, on the west shore of the lake, and a much wider strip of nearly the same character in Michigan, on the east shore. The principal streams entering the lake from the west are Fox and Menominee rivers; from

the east, St. Joseph, Kalamazoo, Grand, Muskegon, and Manistee rivers.

The following pages give the results of data collected during 1906 in the Lake Michigan drainage basin.

ESCANABA RIVER BASIN.

ESCANABA RIVER NEAR ESCANABA, MICH.

The gaging station was established in May, 1903. It is located at a highway bridge 4 miles above the mouth of the river. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 12, where are given also references to publications that contain data for previous years.

Discharge measurements of Escanaba River near Escanaba, Mich., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 19	Horton and Brennan	194	1,270	6.43	7,830
June 9[a]	M. S. Brennan	194	882	4.17	2,880
June 10	do	194	865	4.10	2,580

[a] Heavy run of logs.

Daily gage height, in feet, of Escanaba River near Escanaba, Mich., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		4.3	3.0	3.3	2.2	2.2	2.2	2.8	3.3
2		4.4	3.1	3.2	2.1	2.2	2.2	2.8	3.1
3		4.5	3.2	3.0	2.1	2.2	2.2	2.7	3.0
4		4.4	3.3	2.9	2.2	2.2	2.3	2.8	2.9
5		4.4	3.4	2.8	2.3	2.1	2.2	2.9	2.9
6		4.2	3.6	2.7	2.3	2.1	2.3	2.9	2.8
7		3.9	3.7	2.6	2.1	2.2	2.3	3.0	2.8
8		3.9	4.0	2.6	2.2	2.3	2.4	3.1	2.9
9	4.0	4.0	4.1	2.5	2.3	2.4	2.4	3.1	2.9
10	4.1	3.8	4.1	2.4	2.5	2.5	2.5	3.1	2.8
11	4.3	3.7	4.0	2.4	2.4	2.6	2.5	3.0	2.8
12	4.6	3.5	3.8	3.4	2.2	2.8	2.5	3.1	2.9
13	5.2	3.4	3.9	3.4	2.1	2.9	2.3	3.0	2.9
14	5.3	3.5	3.9	3.3	2.1	2.9	2.3	2.8	2.9
15	5.3	3.4	3.7	3.4	2.3	2.9	2.4	2.8	2.9
16	5.4	3.5	3.5	3.2	2.2	3.1	2.5	2.9	2.8
17	5.6	3.4	3.5	3.2	2.3	3.1	2.4	2.9	2.9
18	6.2	3.3	3.4	3.1	2.1	3.1	2.4	2.8	2.8
19	6.5	3.2	3.3	3.0	2.1	3.0	2.3	2.7	2.8
20	6.8	3.1	3.3	3.1	2.4	3.0	2.4	2.8	2.9
21	6.9	3.1	3.2	2.9	2.4	2.9	2.3	2.9	2.9
22	6.8	3.2	3.3	2.8	2.3	2.9	2.2	2.9	2.9
23	5.9	3.3	3.4	2.7	2.2	2.8	2.2	2.8	(a)
24	5.8	3.4	3.4	2.5	2.2	2.7	2.3	2.9	.....
25	5.5	3.5	3.6	2.3	2.1	2.7	2.2	3.0	.....
26	5.1	3.4	3.7	2.2	2.3	2.6	2.2	3.1	.....
27	5.1	3.3	3.2	2.1	2.3	2.6	2.3	3.2	.....
28	4.7	3.3	3.7	2.2	2.4	2.5	2.4	2.1	.....
29	4.5	3.4	3.5	2.1	2.2	2.4	2.5	3.1	.....
30	4.3	3.3	3.4	2.1	2.2	2.2	2.5	3.0	.....
31	.....	3.2	.....	2.2	2.3	.....	2.6	.....	.....

[a] Frozen.

Rating table for Escanaba River near Escanaba, Mich., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	320	3.10	1,180	4.10	2,530	5.20	4,460
2.20	385	3.20	1,300	4.20	2,690	5.40	4,870
2.30	450	3.30	1,420	4.30	2,850	5.60	5,330
2.40	520	3.40	1,550	4.40	3,010	5.80	5,850
2.50	600	3.50	1,680	4.50	3,180	6.00	6,420
2.60	680	3.60	1,810	4.60	3,350	6.20	7,040
2.70	770	3.70	1,950	4.70	3,520	6.40	7,730
2.80	860	3.80	2,090	4.80	3,700	6.60	8,500
2.90	960	3.90	2,230	4.90	3,880	6.80	9,300
3.00	1,070	4.00	2,380	5.00	4,070	7.00	10,170

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1906, and is well defined between gage heights 2.7 feet and 4.6 feet.

Monthly discharge of Escanaba River near Escanaba, Mich., for 1906.

[Drainage area, 800 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April (9–30)	9,720	2,380	5,170	6.46	5.29
May	3,180	1,180	1,870	2.34	2.70
June	2,530	1,070	1,750	2.19	2.44
July	1,550	320	879	1.10	1.27
August	600	320	411	.514	.59
September	1,180	320	714	.892	1.00
October	680	385	485	.606	.70
November	1,300	770	1,000	1.25	1.40
December (1–22)	1,420	860	964	1.20	.98

NOTE.—Values are rated as follows: May and June, excellent; remainder of the period, good.

MENOMINEE RIVER BASIN.

MENOMINEE RIVER NEAR IRON MOUNTAIN, MICH.

This station was established September 4, 1902. It is located at the Homestead highway bridge, 3.5 miles south of Iron Mountain, Mich. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 14, where are given also references to publications that contain data for previous years.

Discharge measurements of Menominee River near Iron Mountain, Mich., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 18	Horton and Brennan	244	3,210	11.51	10,900
April 18	do	244	3,250	11.67	11,200
June 8 [a]	M. S. Brennan	238	2,960	10.45	8,750
June 9 [a]	do	238	2,820	9.92	8,030

[a] Discharge slightly affected by run of logs.

Daily gage height, in feet, of Menominee River near Iron Mountain, Mich., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	2.48	4.55	3.0	3.8	8.5	8.8	9.2	2.7	2.6	2.9
2	2.42	4.1	3.0	3.9	9.0	6.8	8.3	2.9	3.6	2.25
3	2.4	4.0	2.95	4.3	9.4	7.0	7.5	2.65	3.1	2.3
4	2.5	4.05	2.9	4.75	9.5	5.1	8.6	2.4	2.8	2.4
5	2.5	4.0	2.8	4.9	9.8	7.0	6.4	2.7	2.65	2.5
6	2.6	3.9	2.82	4.92	9.1	6.0	6.2	3.75	2.5	2.45
7	2.58	3.8	2.9	5.0	8.2	8.4	4.1	4.25	2.3	2.4
8	2.5	3.75	2.82	5.05	8.5	10.7	4.0	4.0	2.4	2.5
9	2.4	3.6	2.9	5.35	7.6	11.3	3.6	3.8	2.6	2.6
10	2.4	3.55	2.9	6.1	7.3	10.3	4.75	3.5	2.1	2.55
11	2.3	3.4	3.0	7.15	7.8	8.1	4.4	3.2	2.0	2.75
12	2.4	3.4	3.05	7.9	7.1	7.7	4.3	3.3	2.4	2.65
13	2.85	3.42	3.1	8.25	7.2	6.7	3.9	2.75	4.0	2.7
14	3.45	3.4	3.0	8.9	6.1	4.6	4.1	2.4	3.8	2.75
15	3.6	3.3	3.0	10.6	6.2	3.7	4.6	2.5	3.7	2.4
16	3.6	3.25	3.0	11.05	6.5	4.6	4.3	2.6	3.9	3.25
17	3.5	3.25	2.95	11.4	6.3	2.9	4.1	4.1	3.7	4.05
18	3.35	3.20	2.9	11.7	6.7	2.4	3.8	3.8	3.4	4.15
19	3.0	3.35	3.0	13.1	6.2	2.3	3.6	3.1	3.1	5.0
20	2.7	3.4	2.95	13.7	5.3	3.3	4.2	2.9	2.9	(a)
21	2.7	3.3	2.95	14.3	5.15	4.8	3.9	2.6	2.75	.....
22	2.8	3.3	3.05	14.1	4.35	4.75	3.4	2.85	3.0	.....
23	2.75	3.25	3.05	13.2	2.3	4.3	4.2	3.2	2.9	.....
24	2.8	3.25	2.95	12.15	4.5	4.2	3.9	3.6	2.8	.....
25	3.2	3.20	2.9	11.9	4.7	3.0	3.8	3.9	2.7	.....
26	4.15	3.25	3.05	10.7	5.5	2.6	3.2	4.1	2.65	.....
27	4.85	3.2	3.3	10.1	7.0	8.35	3.8	3.8	2.8	.....
28	5.3	3.05	3.4	9.6	6.7	9.0	3.6	3.6	2.75	.....
29	5.0	.....	3.45	9.4	7.7	8.8	3.4	3.5	2.7	.....
30	4.8	.....	3.55	9.2	8.3	9.1	3.0	3.25	2.8	.....
31	4.8	.....	3.6	.....	8.9	.....	2.8	2.8	.....	.....

[a] Gage reader left.

Rating table for Menominee River near Iron Mountain, Mich., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	1,540	3.30	2,432	4.60	3,396	6.80	5,270
2.10	1,606	3.40	2,503	4.70	3,474	7.00	5,420
2.20	1,672	3.50	2,575	4.80	3,552	7.20	5,615
2.30	1,739	3.60	2,647	4.90	3,630	7.40	5,815
2.40	1,806	3.70	2,719	5.00	3,708	7.60	6,025
2.50	1,874	3.80	2,792	5.20	3,865	7.80	6,235
2.60	1,942	3.90	2,866	5.40	4,023	8.00	6,450
2.70	2,011	4.00	2,940	5.60	4,183	9.00	7,630
2.80	2,080	4.10	3,015	5.80	4,345	10.00	8,930
2.90	2,150	4.20	3,090	6.00	4,510	11.00	10,250
3.00	2,220	4.30	3,166	6.20	4,680	12.00	11,660
3.10	2,290	4.40	3,242	6.40	4,860	13.00	13,100
3.20	2,361	4.50	3,319	6.60	5,040	14.00	14,600

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1902-1906, and is fairly well defined.

Monthly discharge of Menominee River near Iron Mountain, Mich., for 1906.

[Drainage area, 2,420 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	3,940	1,740	2,370	0.979	1.13
February	3,360	2,260	2,590	1.07	1.11
March	2,650	2,080	2,250	.930	1.07
April	15,100	2,790	8,040	3.32	3.70
May	8,670	1,740	5,610	2.32	2.68
June	10,700	1,740	5,040	2.08	2.32
July	7,890	2,080	3,500	1.45	1.67
August	3,130	1,810	2,400	.992	1.14
September	2,940	1,540	2,160	.893	1.00
October (1-19)	3,710	1,710	2,140	.884	.62

NOTE.—Values are rated as follows: January and March to October, fair. It is probable that ice conditions affected the flow during February and that the value given above is considerably in excess of the true value.

PESHTIGO RIVER BASIN.

DESCRIPTION OF BASIN.

Peshtigo River rises in the plateau region of northwestern Wisconsin at an elevation of about 1,600 feet and descends on an average about 10 feet to the mile. But few of its powers have been developed on account of this region being thinly settled. There are falls of 46 feet, 35 feet, and 25 feet at different places on the river that could easily be developed. (See Pl. III.)

PESHTIGO RIVER SURVEY.

In order to point out the power possibilities along Peshtigo River, a survey was made during 1906 from the mouth to Rat River. From the data collected on this survey sheets have been prepared showing a profile of the water surface, a plan of the river, contour along the bank, and prominent natural or artificial features.

The results of this survey have been published on separate sheets and may be had upon application to the Director of the Geological Survey.

PESHTIGO RIVER AT CRIVITZ, WIS.

This station was established April 20 and was discontinued December 12, 1906. It was located on the railroad bridge about one-fourth mile south of Crivitz post-office (or Ellis Junction railroad station).

The channel is straight for about 1,000 feet above and 300 feet below the station. Both banks are of medium height and do not overflow; all the water passes the section, being confined by the railroad embankments. The bed of the stream is gravel and is permanent. There is but one channel at all stages. The current is medium. Log jams and sunken logs affect the discharge at times.

A

B

FALLS ON PESHTIGO RIVER, WISCONSIN.

A, High Falls (40-foot fall); *B*, Caldron Falls (55-foot fall).

Discharge measurements are made from the upstream side of the bridge, to which the gage is attached.

A standard chain gage, attached to the upstream side of the bridge, was read during 1906 by Andrew Johnson; length of chain, 22.85 feet. The bench mark is the top of parapet wall of left abutment, extreme downstream end, near front face, marked with white paint; elevation, 21.52 feet. The reference point is the center of gage pulley; elevation, 22.66 feet. Elevations refer to the datum of the gage.

Discharge measurements of Peshtigo River at Crivitz, Wis., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 20	Horton and Brennan	136	897	9.88	2,520
June 8	M. S. Brennan	135	822	9.70	2,030
June 29	do	127	650	8.26	1,560

Daily gage height, in feet, of Peshtigo River at Crivitz, Wis., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		8.9	7.9	6.2	4.3	5.7	5.7	6.7	6.9
2		8.4	6.8	6.0	5.6	6.1	5.4	6.3	7.0
3		9.5	6.7	6.1	5.0	5.5	5.2	6.7	7.4
4		7.2	6.4	6.0	4.3	6.6	4.0	6.2	6.5
5		7.9	6.7	8.5	5.3	6.6	5.4	5.7	6.2
6		8.4	7.9	7.1	5.8	6.2	5.3	5.9	6.3
7		6.6	8.5	6.8	5.8	6.2	5.4	5.9	6.5
8		7.3	8.4	6.6	6.1	5.6	5.4	5.9	6.2
9		8.2	9.7	6.8	5.9	5.6	5.2	5.8	6.0
10		6.4	9.8	6.5	5.8	4.0	5.7	5.7	6.1
11		7.1	7.4	6.1	5.7	5.5	5.3	5.9	5.8
12		5.9	6.9	6.6	5.9	5.8	5.4	6.0	6.2
13		6.7	7.7	6.2	5.5	5.7	5.6	5.9	
14		6.5	7.3	6.0	6.4	5.7	5.4	6.0	
15		7.7	8.4	6.6	5.0	5.4	5.6	6.0	
16		6.5	8.3	6.5	5.5	5.5	5.3	5.9	
17		6.5	6.2	6.8	5.2	5.8	5.4	5.9	
18		6.0	6.1	6.4	5.3	5.9	5.3	6.1	
19		6.7	6.3	6.5	5.3	6.5	5.4	5.7	
20	9.8	6.2	7.5	6.1	5.6	6.0	5.6	5.7	
21	10.4	6.5	7.5	6.6	5.3	5.8	6.6	5.8	
22	10.7	6.7	8.5	6.5	5.7	5.8	6.5	6.0	
23	10.6	6.6	8.4	5.8	5.6	5.7	6.6	5.9	
24	10.5	6.5	8.5	5.3	5.4	5.7	6.7	5.8	
25	9.9	7.1	8.5	5.4	6.2	5.9	6.8	5.8	
26	9.3	6.6		5.7	5.2	5.7	6.9	7.0	
27	8.5	8.4		5.7	6.1	5.9	7.5	6.8	
28	8.6	8.7		5.7	6.0	6.4	7.3	7.2	
29	8.5	7.4	6.9	5.8	6.8	6.0	7.2	6.8	
30	8.1	7.7	7.0	5.6	6.1	5.7	6.8	6.9	
31		7.9		5.3	6.0		6.7		

PESHTIGO RIVER AT HERMAN'S FARM, NEAR CRIVITZ, WIS.

This station was established September 7, 1906, under the direction of D. W. Mead. It is located at Herman's farm, 4½ miles west of Crivitz, Wis., in the northwest quarter of sec. 26, T. 32 N., R. 19 E.

The channel is straight for about 800 feet above the station and for 300 feet below. The banks do not overflow. The bottom of the

river is gravel and permanent. There is one channel at all stages. The current is swift.

Discharge measurements are made from a boat which is held in position by means of a rope stretched across the river.

The gage, which is read daily by Rose Herman, consists of two sections. The bench mark is a copper nail in top of a pine stump 50 feet from the water's edge and about 50 feet southeast of the gage: elevation, 731.70 feet above sea level and 19.82 feet above the datum of the gage.

Discharge measurements of Peshtigo River at Herman's farm, near Crivitz, Wis., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
September 7	V. H. Reineking	128	436	3.40	657
October 29	do	130	463	4.20	1,020
November 16	do	125	380	3.20	562

Daily gage height, in feet, of Peshtigo River at Herman's farm, near Crivitz, Wis., for 1906.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1	.....	3.0	3.7	4.2	17	3.4	3.0	3.4	3.3
2	.....	2.95	3.75	4.0	18	3.45	3.05	3.5	3.3
3	.....	2.3	3.5	3.9	19	3.5	3.3	3.5	3.35
4	.....	3.25	3.4	3.9	20	3.4	3.5	3.45	3.4
5	.....	3.0	3.4	3.8	21	3.4	3.7	3.5	3.2
6	.....	3.0	3.35	3.6	22	3.4	3.8	3.3	3.2
7	3.4	2.95	3.35	3.6	23	3.45	3.8	3.3	3.25
8	3.2	3.0	3.4	3.5	24	3.4	3.9	3.35	3.15
9	3.0	3.0	3.4	3.6	25	3.4	4.0	3.4	3.1
10	3.0	3.05	3.5	3.55	26	3.4	4.1	3.8	3.1
11	3.0	2.8	3.5	3.5	27	3.0	4.2	4.0	3.05
12	3.15	3.2	3.45	3.3	28	3.7	4.15	4.2	3.15
13	3.2	3.05	3.4	3.35	29	3.35	4.2	4.3	3.1
14	3.1	3.0	3.3	3.3	30	3.15	4.0	4.25	3.05
15	3.1	3.0	3.25	3.3	31	.....	3.9	.....	3.1
16	3.3	3.0	3.2	3.3					

Rating table for Peshtigo River at Herman's farm, near Crivitz, Wis., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.30	280	2.90	455	3.40	645	3.90	870
2.40	305	3.00	490	3.50	690	4.00	920
2.50	330	3.10	525	3.60	735	4.10	970
2.60	360	3.20	565	3.70	780	4.20	1,020
2.70	390	3.30	605	3.80	825	4.30	1,070
2.80	420						

NOTE.—The above table is applicable only for open-channel conditions. It is based on three discharge measurements made during 1906, and is well defined between gage heights 3.2 feet and 4.2 feet.

Monthly discharge of Peshtigo River at Herman's farm, near Crivitz, Wis., for 1906.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
September (7-30)	780	490	601
October	1,020	280	646
November	1,070	565	710
December	1,020	508	653

NOTE.—Values for 1906 are good.

OCONTO RIVER BASIN.

DESCRIPTION OF BASIN.

Oconto River rises in a number of small lakes and swamps in the plateau region at an elevation of about 1,530 feet above sea level and descends 945 feet in its length of 87 miles. About two-thirds of its total fall is in the upper 35 miles of its course. At Undershell it turns abruptly and flows nearly due east, joining Lake Michigan near Oconto. The most important water powers are found in the last 33 miles of its course, in which distance the river descends 190 feet.

OCONTO RIVER AT GILLETT, WIS.

This station was established June 7, 1906. It is located at the highway bridge about 2½ miles south of Gillett, Wis.

The channel is straight for about 200 feet above and 300 feet below the station. Both banks are low but do not overflow. The bed of the stream is gravel and is permanent. The current is swift. Old pier foundations at both banks may affect the flow somewhat.

A standard chain gage, which was read during 1906 by Samuel Gilbertson and Hattie Gilbertson, is fastened to the lower side of the bridge; length of chain, 24.82 feet. The reference point is the top of downstream board guard rail 59 feet from the initial point; elevation, 17.75 feet above gage datum.

Discharge measurements of Oconto River at Gillett, Wis., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 7	M. S. Brennan	81	359	5.95	926
June 29	do	77	339	5.72	727

Daily gage height, in feet, of Oconto River at Gillett, Wis., for 1906.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		5.4	4.75	5.15	5.1	6.05	6.7
2		5.5	4.7	5.15	5.4	6.0	6.7
3		5.7	4.75	5.7	5.2	5.9	6.6
4		6.15	4.75	5.7	5.2	5.8	6.15
5		5.75	4.2	5.5	4.9	5.8	6.95
6		6.0	4.25	5.6	5.1	5.85	5.6
7	5.95	6.0	4.85	5.6	5.4	5.7	6.1
8	6.0	5.8	4.9	5.0	5.4	5.8	7.25
9	6.15	5.75	4.8	5.2	5.1	5.8	7.5
10	6.1	5.6	5.1	5.25	5.2	5.7	7.85
11	5.95	5.6	5.4	5.3	5.0	4.6	8.3
12	5.9	5.6	5.7	5.25	5.3	5.7	9.1
13	6.2	5.5	5.3	5.2	6.15	5.4	7.8
14	6.15	5.1	5.3	5.65	4.3	5.7	7.4
15	5.6	5.2	5.3	4.9	5.35	5.5	7.35

Daily gage height, in feet, of Oconto River at Gillett, Wis., for 1906—Continued.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	5.65	5.2	5.4	6.15	5.3	5.5	6.8
17	5.6	5.8	5.3	5.8	5.3	5.95	7.7
18	5.6	5.0	4.8	5.8	5.3	5.9	8.1
19	5.0	4.95	4.5	5.9	5.8	6.2	9.0
20	5.4	5.0	5.2	6.0	6.0	6.2	9.1
21	5.7	5.0	5.2	6.0	6.1	6.35	(a)
22	6.0	5.5	5.2	5.1	6.0	6.3	.....
23	6.0	5.0	5.9	5.3	6.2	6.25	.....
24	6.2	4.9	5.6	5.5	6.15	6.15	.....
25	5.85	4.85	5.8	5.5	5.9	5.7	.....
26	5.75	4.8	6.0	5.5	6.1	7.05	.....
27	5.65	4.75	6.3	5.5	6.4	7.3	.....
28	5.75	4.75	6.2	5.4	6.4	7.35	.....
29	5.75	4.4	6.1	5.05	6.7	7.3	.....
31	5.65	4.7	5.9	5.0	6.3	7.2	.....
31	.....	4.7	5.6	.....	6.1	.....	.....

a Frozen.

OCONTO RIVER AT STILES, WIS.

This station was established April 20, 1906, but was discontinued June 6, 1906, as the dam immediately above the station seriously modified the flow.

Discharge measurements of Oconto River at Stiles, Wis., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 20	Horton and Brennan	119	517	4.74	2,510
June 6	M. S. Brennan	120	250	2.71	988

Daily gage height, in feet, of Oconto River at Stiles, Wis., for 1906.

Day.	Apr.	May.	June.	Day.	Apr.	May.	June.
1	.....	4.0	3.0	17	.....	3.8	.....
2	.....	3.8	2.4	18	.....	4.0	.....
3	.....	3.6	3.2	19	.....	4.4	.....
4	.....	3.8	2.5	20	4.9	2.6	.....
5	.....	3.3	2.7	21	4.8	4.0	.....
6	.....	4.5	2.8	22	4.7	4.1	.....
7	.....	2.8	.....	23	4.4	4.0	.....
8	.....	4.5	.....	24	4.6	4.1	.....
9	.....	4.2	.....	25	4.6	3.3	.....
10	.....	4.2	.....	26	4.8	3.7	.....
11	.....	4.1	.....	27	4.6	2.8	.....
12	.....	4.4	.....	28	4.3	3.3	.....
13	.....	4.7	.....	29	3.8	2.3	.....
14	.....	3.4	.....	30	3.8	3.1	.....
15	.....	4.4	.....	31	.....	3.3	.....
16	.....	4.2	.....				

WOLF RIVER BASIN.

DESCRIPTION OF BASIN.

Wolf River rises in a number of small lakes 25 miles south of the northern boundary of Wisconsin and flows in a general southerly direction, entering upper Fox River at a point about 10 miles west

of Lake Winnebago. In the upper half of its course the descent of Wolf River is very rapid. At the Chicago and Northwestern Railroad crossing near Lenox it has an elevation of 1,562 feet above sea level, and between this point and Shawano, 80 miles, the river falls practically 10 feet per mile. Shawano is the head of navigation; below this point the river is very sluggish, with no opportunities for water power.

WOLF RIVER AT DARROW'S BRIDGE, NEAR SHAWANO, WIS.

A station was established April 21, 1906, at Darrow's bridge, about 2 miles south of Shawano, and was discontinued June 6, 1906, as the dam above modified the flow.

A measurement was made April 21, 1906, by Horton and Brennan, with the following results:

Width, 188 feet; area, 1,350 square feet; gage height, 5.87 feet; discharge, 3,890 second-feet.

Daily gage height, in feet, of Wolf River at Darrow's bridge, near Shawano, Wis., for 1906.

Day.	Apr.	May.	June.	Day.	Apr.	May.	June.
1		4.7	4.8	17		4.8	
2		4.7	4.3	18		4.1	
3		4.5		19		4.1	
4		4.0	3.8	20			
5		4.8		21	6.1	4.2	
6				22		3.6	
7		4.6		23	5.4	3.9	
8		4.7		24	5.3	3.8	
9		4.3		25	5.0	4.2	
10		4.6		26	4.7	4.2	
11		3.5		27	4.7		
12		4.2		28	4.6	3.6	
13				29		5.2	
14		4.8		30	4.5	5.0	
15		4.8		31		4.3	
16		4.7					

WOLF RIVER AT WHITE HOUSE BRIDGE, NEAR SHAWANO, WIS.

This station was established June 6, 1906. It is located at the "White House" highway bridge, about 3½ miles north of Shawano, Wis.

The channel is straight for about 200 feet above and 500 feet below the station. Both banks are of medium height and do not overflow. The bed of the stream is gravel and is permanent. There is one channel at all stages. The current is medium swift. This station may be affected by back water from the dam about 4 miles below.

A standard chain gage, which is read daily by Albert Utke, is fastened to the guard rail on the upstream side of the bridge; length of chain, 16.25 feet. The reference point is the center of gage pulley; elevation, 16.07 feet above gage datum.

Discharge measurements of Wolf River near Shawano, Wis., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 6	M. S. Brennan	136	767	6.90	1,970
June 30	do	132	629	5.96	590

Daily gage height, in feet, of Wolf River near Shawano, Wis., for 1906.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1			6.5	6.5	5.8	6.8	7.7
2		6.8	6.3		5.8	6.7	(a)
3		8.2	6.4	6.5	5.9	6.6	
4		7.6	6.2	6.6	6.0		
5	6.9	7.6		6.4	6.1	6.2	
6	7.4	7.4	6.2	6.2	6.0	6.4	
7	7.7	7.3	6.2	6.1		6.8	
8	7.9		6.0	5.9	6.3	6.5	
9	7.7	7.1	5.9		6.1	6.1	
10	7.7	6.4	6.0	6.0	6.1	6.4	
11	7.1	6.5	6.7	6.4	6.4		
12	6.9	6.4		6.4	6.4	6.2	
13	7.0	6.8	6.2	6.2	6.0	5.9	
14	6.5	6.9	6.2	6.1		6.6	
15	6.8		6.0	6.3	6.1	6.3	
16	6.6	6.5	6.0		6.1	6.3	
17	6.6	6.3	6.5	7.0	6.0	6.6	
18	6.5	6.0	6.3	6.6	6.3		
19	6.7	6.2		6.6	6.3	6.7	
20	6.5	5.8	6.0	6.4	6.9	7.2	
21	6.9	6.3	5.9	6.3		7.0	
22	7.2		6.0	6.4	6.5	7.3	
23	6.8	6.4	6.3		6.3	7.3	
24		6.1	6.2	6.1	6.6	7.2	
25	6.0	5.7	6.0	6.2	6.9		
26	6.7	6.1		6.1	6.7	8.1	
27	6.6	6.2	6.7	6.0	6.7	8.1	
28	6.5	6.2	6.4	5.9		7.4	
29	6.4		7.2	5.8	6.7	7.6	
30	5.8	5.8	6.2		6.5	7.1	
31		6.0	5.8		6.6		

a Frozen.

ST. JOSEPH RIVER BASIN.

DESCRIPTION OF BASIN.

St. Joseph River rises at Bunday Hills, in northern Hillsdale County, Mich., flows southwestward into Indiana, turns northward at South Bend, recrosses the State line near Bertrand, and debouches into Lake Michigan at St. Joseph. The total area drained is approximately 4,586 square miles, of which 2,916 square miles are in Michigan and 1,670 square miles are in Indiana. The drainage basin contains more than 400 small lakes, varying in surface area from one-eighth of a square mile to 6 square miles. Of these, approximately 100 are in Indiana and 300 in Michigan. No storage is developed on the stream.

Elkhart River, one of the principal Indiana tributaries of the St. Joseph, drains an area of about 500 square miles, which contains large lakes and extended swamps, the principal fall of the stream occurring in its passage from marsh to marsh.

ST. JOSEPH RIVER AT MENDON, MICH.

This station is located at the Marantette Bridge, near Mendon, Mich.

Daily gage heights were obtained during 1906, but are not published, owing to the following sources of errors in any estimates of flow which might be based on them: (1) Inaccuracy of discharge measurements caused by the poor natural conditions of flow; (2) backwater from dam below the station; (3) the growth of aquatic plants in the channel, which changes the relation of gage height to discharge during the summer; (4) occasional backwater from Portage Creek, which enters the St. Joseph between the gage and the measuring section and complicates the problem somewhat. This creek flows parallel to and about 1 mile distant from the St. Joseph at Mendon and was at one time diverted across the divide, affording water power with a fall of 20 feet, but this diversion has been discontinued.

A measurement was made April 19, 1906, by D. F. Mott, with the following results:

Width, 100 feet; area, 589 square feet; gage height, 228 feet; discharge, 1,590 second-feet.

ST. JOSEPH RIVER NEAR BUCHANAN, MICH.

This station was established April 1, 1901. It is located at the dam of the South Bend Electric Company, 1 mile below the village of Buchanan. The conditions at this station are described in Water-Supply Paper No. 170, page 20, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of St. Joseph River near Buchanan, Mich., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,320	6,042	3,559	4,983	3,416	2,899	1,758	1,644	1,200	684	1,862	6,481
2	3,303	5,004	3,742	5,288	3,544	2,826	2,407	1,969	1,391	1,053	1,776	3,521
3	3,377	4,108	4,508	4,798	3,802	2,399	2,326	1,841	2,187	1,327	1,484	3,810
4	3,394	3,615	5,699	4,505	2,183	2,774	1,895	1,734	1,934	1,558	946	3,202
5	3,637	3,897	6,069	4,194	2,590	2,214	2,485	1,286	1,904	1,753	1,849	2,460
6	3,270	3,196	5,581	4,108	3,126	2,745	2,127	1,834	1,807	1,648	1,838	3,887
7	2,542	2,888	5,300	4,137	3,344	2,756	2,077	1,806	2,145	1,218	1,606	5,811
8	3,521	3,245	5,145	4,060	3,077	2,574	1,924	1,966	1,787	1,674	1,567	5,978
9	3,706	4,058	5,073	4,371	2,986	3,791	2,252	2,229	1,056	2,065	1,924	5,023
10	3,204	3,656	4,841	4,722	3,014	4,542	1,917	2,705	1,464	1,338	1,846	5,558
11	2,846	3,054	4,321	4,804	2,897	5,909	1,894	4,542	1,520	1,948	839	5,685
12	2,744	3,710	4,764	4,774	2,762	5,868	2,120	2,794	1,810	1,661	1,482	5,530
13	2,701	3,823	4,420	4,520	2,271	5,525	2,012	2,835	1,556	1,595	1,773	5,503
14	2,515	3,603	4,191	4,739	2,913	5,535	2,133	2,462	1,868	1,079	1,781	5,044
15	2,840	3,824	4,036	5,161	2,929	4,826	1,712	3,806	1,868	935	1,708	5,006

Daily discharge, in second-feet, of St. Joseph River near Buchanan, Mich., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	3,268	3,403	3,899	6,133	3,095	4,696	2,180	1,437	1,324	1,237	1,671	[illegible]
17	2,831	2,914	3,773	5,752	3,406	3,621	1,772	1,838	1,014	1,601	1,849	[illegible]
18	2,929	2,820	3,350	5,635	3,513	4,118	1,537	1,754	1,719	1,537	990	[illegible]
19	2,941	3,630	4,033	5,182	3,499	3,646	1,539	1,650	2,028	1,373	1,820	[illegible]
20	3,100	3,387	3,643	4,978	3,572	3,442	1,316	2,125	1,589	1,518	1,821	[illegible]
21	3,157	3,290	3,481	4,630	3,695	3,202	1,624	1,810	1,638	1,175	2,069	[illegible]
22	5,473	3,529	3,294	4,101	3,266	3,044	775	1,907	1,398	1,050	2,907	[illegible]
23	8,461	3,568	3,168	4,798	2,880	2,804	1,722	1,657	573	1,777	2,604	[illegible]
24	8,648	3,843	3,156	3,915	3,104	2,471	1,511	1,699	1,032	1,729	4,032	[illegible]
25	7,617	3,261	2,853	3,347	2,753	3,111	1,627	1,521	1,332	1,646	4,157	[illegible]
26	7,179	4,418	3,781	3,672	2,588	2,821	1,512	1,195	1,122	1,559	4,821	[illegible]
27	7,501	4,167	4,169	4,074	2,542	2,490	1,323	2,204	1,325	1,391	4,666	[illegible]
28	6,856	3,773	5,718	3,822	3,145	2,537	1,348	1,929	989	1,100	4,599	[illegible]
29	6,442	.....	5,528	3,500	3,145	2,303	930	1,933	1,639	1,611	4,516	[illegible]
30	6,618	.....	5,501	3,911	2,987	2,282	1,906	1,258	756	1,781	4,210	[illegible]
31	6,382	.....	5,568	.....	2,949	.....	1,631	1,479	.....	1,824	.....	[illegible]

Monthly discharge of St. Joseph River near Buchanan, Mich., for 1906.

[Drainage area, 3,940 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	8,650	2,520	4,400	1.12	[illegible]
February	6,040	2,820	3,700	.939	[illegible]
March	6,070	2,850	4,390	1.11	[illegible]
April	6,130	3,350	4,550	1.15	[illegible]
May	3,800	2,180	3,060	.777	[illegible]
June	5,910	2,210	3,460	.878	[illegible]
July	2,480	775	1,780	.452	[illegible]
August	4,540	1,200	2,030	.515	[illegible]
September	2,190	573	1,500	.381	[illegible]
October	2,060	684	1,470	.373	[illegible]
November	4,820	839	2,370	.602	[illegible]
December	6,480	2,160	4,170	1.06	[illegible]
The year	8,650	573	3,070	.780	[illegible]

KALAMAZOO RIVER BASIN.

DESCRIPTION OF BASIN.

Kalamazoo River rises in southwestern Jackson County, Mich., flows in a general northwesterly direction, and enters Lake Michigan at Saugatuck. Its length is about 100 miles.

Owing to its steady regimen the Kalamazoo is of great value for water power. Within the past five years three dams and power plants have been constructed to generate electricity for electric traction. An additional plant for this purpose is now under construction at Ceresco. Water power is also used for general manufacturing purposes at Allegan, Battle Creek, Albion, and other points.

KALAMAZOO RIVER NEAR ALLEGAN, MICH.

This station was established April 4, 1901. It is located at the dam of the Commonwealth Power Company, in Trowbridge Township, 6 miles upstream by the river from Allegan. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 22, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Kalamazoo River near Allegan, Mich., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,112	1,685	1,467	2,821	1,268	1,197	603	869	641	349	812	1,251
2	1,279	1,457	1,744	2,242	1,096	1,026	1,027	477	475	306	915	983
3	1,157	1,218	2,612	2,039	1,156	1,011	1,112	852	411	876	1,045	1,274
4	1,185	984	2,381	1,898	1,342	905	903	760	829	513	904	1,129
5	1,185	1,221	2,214	1,676	1,150	1,136	1,091	632	666	446	983	864
6	1,248	1,116	2,382	1,861	1,184	1,021	1,239	1,091	713	535	804	1,431
7	899	1,167	2,195	1,817	1,062	999	964	1,011	925	581	904	1,902
8	1,176	978	2,275	1,597	1,228	1,192	881	1,028	647	705	569	1,819
9	1,034	1,045	2,061	1,562	1,089	2,533	1,154	917	379	1,052	890	1,670
10	999	785	1,810	1,669	1,234	2,767	1,189	806	547	757	818	1,635
11	783	961	1,609	1,177	971	2,638	1,001	877	622	525	407	1,904
12	602	988	1,431	1,755	1,200	2,610	859	783	648	412	1,044	1,729
13	1,105	1,189	1,590	1,805	1,064	2,729	637	1,018	563	768	983	1,525
14	899	1,592	1,400	2,151	2,033	2,924	573	1,198	687	650	1,018	1,571
15	1,125	1,221	1,406	2,283	2,311	2,378	517	993	557	859	807	1,634
16	1,336	1,185	1,551	2,038	1,983	2,111	834	961	243	545	1,097	1,545
17	1,258	1,128	1,371	2,192	1,821	1,915	954	1,061	635	537	1,321	1,351
18	1,339	1,097	1,133	2,263	2,055	1,061	866	977	533	763	.....	1,306
19	1,318	1,221	1,336	2,233	1,827	1,353	875	.....	799	461	.....	1,366
20	1,553	1,218	1,307	1,856	1,691	1,444	765	.....	714	805	732	1,034
21	2,755	1,469	1,312	1,287	1,465	1,296	793	.....	546	242	1,355	961
22	3,454	1,473	1,118	1,755	1,124	1,344	683	496	792	778	1,699	1,061
23	3,528	1,451	1,178	1,160	1,176	1,252	776	496	330	532	1,621	1,224
24	2,931	1,998	1,042	1,350	1,178	1,088	761	581	853	933	1,669	1,269
25	3,473	2,042	851	1,263	1,031	1,098	731	712	619	758	1,521	512
26	3,557	1,653	1,612	1,327	1,101	1,089	683	718	588	467	1,487	707
27	3,395	1,597	2,350	1,240	1,073	1,073	490	802	623	624	1,553	502
28	3,317	1,656	2,070	1,326	1,037	1,143	445	666	697	1,009	1,525	813
29	2,721	.....	2,247	1,073	1,131	1,085	556	616	482	1,110	1,088	988
30	2,167	.....	2,139	1,067	1,173	1,017	1,102	765	105	1,245	1,316	1,061
31	2,139	.....	2,616	.....	1,094	.....	1,112	471	.....	837	.....	1,304

Monthly discharge of Kalamazoo River near Allegan, Mich., for 1906.

[Drainage area, 1,470 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	3,560	602	1,810	1.23	1.42
February	2,040	785	1,310	.890	.93
March	2,620	851	1,740	1.18	1.36
April	2,820	1,070	1,730	1.18	1.32
May	2,310	971	1,330	.905	1.04
June	2,920	905	1,550	1.05	1.17
July	1,240	445	844	.574	.66
August (28 days)	1,200	471	808	.550	.57
September	925	105	596	.405	.45
October	1,240	242	677	.461	.53
November (28 days)	1,700	407	1,100	.748	.78
December	1,900	502	1,270	.864	1.00

REED'S SPRINGS, NEAR ALBION, MICH.

A gaging station was established at this place December 7 and 8, 1904, for the purpose of obtaining information concerning the permanence of the supply furnished to streams by the numerous springs in the moraines. It was discontinued June 30, 1906. The conditions at this station are described in Water-Supply Paper No. 171, page 24.

Gage height, in feet, and discharge, in second-feet, of Reed's springs, near Albion, Mich., for 1906.

Date.	Gage height on weir.	Discharge.	Date.	Gage height on weir.	Discharge.
	Feet.	*Sec.-feet.*		*Feet.*	*Sec.-feet.*
January 7	1.09	2.66	May 13	1.10	2.75
April 1	1.10	2.75	May 20	1.10	2.75
April 8	1.10	2.75	May 27	1.10	2.75
April 15	1.10	2.75	June 3	1.10	2.75
April 22	1.10	2.75	June 11	1.10	2.75
April 29	1.10	2.75	June 17	1.10	2.75

GRAND RIVER BASIN.

DESCRIPTION OF BASIN.

Grand River rises in the southern part of Jackson County, Mich., flows in a general northerly and northwesterly direction, and empties into Lake Michigan at Grand Haven. Its drainage area, which comprises a rich agricultural region in the south-central portion of Michigan, includes extensive swamps and marshes but comparatively few lakes. At Grand Rapids the stream passes over a limestone ledge, making a considerable fall, which has been developed for power purposes, and at Grand Ledge a similar descent occurs over sandstone.

The Grand receives a number of important tributaries, notably Flat, Thornapple, Maple, Lookingglass, and Red Cedar rivers.

GRAND RIVER AT NORTH LANSING, MICH.

This station was established March 2, 1901, and was discontinued August 4, 1906. It was located at the Seymour Street Bridge, a short distance below the North Lansing dam. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 26, where are given also references to publications that contain data for previous years.

Discharge measurements of Grand River at North Lansing, Mich., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 20	D. L. Mott	177	966	4.90	1,780
June 16	Horton and Covert	183	811	[a] 5.20	1,400

[a] Uncertain.

Daily gage height, in feet, of Grand River at North Lansing, Mich., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	3.24	4.69	3.59	5.23	2.95	3.02	2.08	2.30
2	3.13	3.75	3.43	4.57	3.02	2.80	2.33	2.55
3	2.98	3.44	6.08	4.33	3.39	2.27	1.93	2.35
4	3.02	3.22	6.82	4.53	3.27	2.52	1.98	3.05
5	3.08	4.02	6.37	3.68	2.96	2.97	2.68	.....
6	3.09	3.58	6.24	4.07	2.63	2.43	2.70	.....
7	2.55	3.42	5.42	4.17	2.95	2.38	2.52	.....
8	2.47	3.27	4.88	4.02	2.70	5.12	2.63	.....
9	2.54	3.15	4.60	4.74	2.75	9.23	2.48	.....
10	2.52	3.09	3.96	5.27	2.82	9.88	2.35	.....
11	2.56	2.42	4.18	5.43	2.91	8.57	2.08	.....
12	2.66	2.98	3.39	5.05	2.72	7.43	2.05	.....
13	2.42	2.66	3.86	4.98	2.52	6.07	2.15	.....
14	2.14	3.06	3.56	5.18	3.33	5.50	2.07	.....
15	2.96	3.44	3.32	6.58	4.23	4.60	2.10	.....
16	3.48	3.02	3.46	6.78	4.45	4.05	2.35	.....
17	3.88	2.70	3.14	6.35	3.89	3.31	2.30	.....
18	3.48	2.20	2.80	5.52	3.87	3.46	2.03	.....
19	3.54	2.66	3.20	5.52	3.28	3.33	2.08	.....
20	3.76	2.51	2.96	4.73	3.02	2.97	2.00	.....
21	5.89	3.48	2.99	4.00	2.88	3.02	2.05	.....
22	7.56	3.93	2.90	4.27	2.90	2.90	2.03	.....
23	8.92	3.79	2.66	3.42	2.55	2.63	2.33	.....
24	9.14	3.78	2.76	3.37	2.42	2.53	2.10	.....
25	8.5	3.70	2.41	3.48	2.42	2.72	2.18	.....
26	7.26	4.40	3.44	3.45	2.42	2.47	2.08	.....
27	6.42	3.94	5.10	3.20	1.82	2.40	2.15	.....
28	5.77	3.30	6.72	3.10	3.13	2.20	2.17	.....
29	5.34	.....	6.90	3.17	3.38	2.37	1.83	.....
30	5.01	.....	6.36	3.23	2.97	2.17	2.33	.....
31	4.61	.....	5.60	.....	3.07	.....	2.43	.....

Rating table for Grand River at North Lansing, Mich., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	251	3.10	761	4.40	1,420	6.40	2,730
1.90	281	3.20	807	4.50	1,475	6.60	2,900
2.00	313	3.30	854	4.60	1,530	6.80	3,080
2.10	347	3.40	902	4.70	1,585	7.00	3,260
2.20	383	3.50	950	4.80	1,640	7.20	3,445
2.30	421	3.60	999	4.90	1,700	7.40	3,635
2.40	461	3.70	1,049	5.00	1,760	7.60	3,830
2.50	502	3.80	1,099	5.20	1,880	7.80	4,030
2.60	544	3.90	1,149	5.40	2,000	8.00	4,240
2.70	586	4.00	1,200	5.60	2,130	9.00	5,370
2.80	629	4.10	1,255	5.80	2,265	10.00	6,680
2.90	672	4.20	1,310	6.00	2,405		
3.00	716	4.30	1,365	6.20	2,565		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1902-1906, and is well defined below gage heights 5.4 feet and fairly well above gage height 5.4 feet.

Monthly discharge of Grand River at North Lansing, Mich., for 1906.

[Drainage area, 1,230 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	5,540	361	1,610	1.31	1.51
February	1,580	383	887	.721	.75
March	3,170	465	1,450	1.18	1.36
April	3,060	761	1,530	1.24	1.38
May	1,450	257	737	.599	.69
June	6,510	372	1,410	1.15	1.28
July	596	260	392	.319	.37
August (1-4)	738	421	531	.432	.06

NOTE.—Values are rated as follows: January to March and June, good; remainder of the period, excellent.

GRAND RIVER AT GRAND RAPIDS, MICH.

This station was established March 12, 1901, by L. W. Anderson, city engineer of Grand Rapids. It is located at the Fulton Street Bridge. The gage is read by assistants in city engineer's office.

The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 29, where are given also references to publications that contain data for previous years.

A measurement was made during 1906 at gage height 7.58 feet, which indicated a discharge nearly 25 per cent in excess of the rating used for 1905. Owing to lack of data tending either to confirm or discredit this measurement, it was considered inadvisable to make estimates of flow for 1906. It is believed, however that the 1905 rating probably applies correctly for 1906.

Daily gage height, in feet, of Grand River at Grand Rapids, Mich., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.95	5.12	.....	1.85	1.32	.....	−0.08	−0.48	0.50	0.70	1.95
2	1.75	4.60	4.68	4.78	1.88	1.22	0.25	− .38	.....	.35	.55	.....
3	2.12	2.35	5.52	4.25	1.75	.....	.28	− .35	.....	.22	.60	1.40
4	2.30	.....	.....	3.72	1.85	.85	.....	− .35	− .45	.12	.....	1.00
5	1.55	3.35	7.05	3.35	1.80	1.18	− .10	.....	− .48	.05	.32	.60
6	1.38	4.60	7.25	3.25	.....	1.90	− .10	− .45	− .50	− .05	.28	.70
7	.....	4.72	7.15	3.22	1.85	1.28	− .15	− .35	− .58	.....	.25	1.40
8	1.50	4.68	6.68	.....	1.45	1.20	.....	− .05	− .58	− .05	.20	1.32
9	1.80	4.48	5.90	3.55	1.35	1.50	+ .05	+ .40	.....	− .02	.18	.....
10	1.68	4.20	5.15	4.50	1.30	.....	− .02	.60	− .60	.00	.18	.....
11	1.65	.....	.....	5.05	1.20	4.22	− .15	.82	− .58	− .15	.....	2.15
12	1.35	3.20	4.15	5.20	1.15	4.95	− .15	.....	− .50	− .05	.00	2.05
13	1.25	3.00	3.70	5.18	.....	4.75	− .18	.48	− .42	− .20	.00	2.05
14	.....	3.35	3.25	5.35	1.95	4.30	− .18	+ .38	− .38	.....	.00	2.30
15	1.08	3.50	3.0	.....	1.95	3.15	.....	− .02	− .40	− .20	− .10	2.35
16	2.48	3.15	2.65	6.75	2.35	2.65	− .10	− .08	.....	− .28	− .10	.....
17	2.45	3.10	2.32	6.95	2.50	.....	− .05	− .25	− .32	− .28	+ .40	3.05
18	2.20	.....	.....	7.05	2.30	1.65	− .05	− .22	− .38	− .30	.....	2.75
19	2.90	2.55	2.02	6.70	1.80	1.60	− .10	.....	− .35	− .25	.40	2.30
20	3.15	2.45	1.85	5.88	.....	1.30	− .15	− .30	− .30	− .28	.60	1.95
21	5.95	4.25	1.75	4.80	1.44	1.25	− .30	− .28	− .28	.....	.85	1.85
22	8.28	.....	1.35	.....	1.10	1.20	.....	− .32	− .22	− .28	1.70	1.60
23	9.78	4.80	1.25	3.65	.95	1.10	− .35	− .25	.....	− .25	2.55	.....
24	10.65	5.82	1.45	3.30	.80	.....	− .35	− .18	− .05	− .28	2.85	1.45
25	11.50	.....	.....	2.90	.75	.62	− .40	− .30	− .30	− .15	.....	1.30

Daily gage height, in feet, of Grand River at Grand Rapids, Mich., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26	11.65	6.82	1.80	2.65	0.60	0.70	−0.40	.....	−0.30	−0.05	2.75	1.05
27	11.18	6.48	3.50	2.38	.....	.70	− .38	+0.08	− .35	+ .30	2.00	.80
28	.....	5.65	4.90	2.25	.75	.62	.40	− .08	− .35	.....	2.55	.85
29	9.15	.....	5.55	.....	1.05	.45	.....	− .18	+ .18	.65	.....	.45
30	8.10	.....	5.88	1.80	.....	.40	− .02	− .35	.....	.85	2.15	.....
31	6.98	.....	5.80	.....	1.25	.....	− .02	− .38	.....	.80	.....	2.05

MUSKEGON RIVER BASIN.

DESCRIPTION OF BASIN.

Muskegon River drains an area 2,663 square miles in extent, lying directly north of the Grand River basin. Its headwaters rise in the north-central part of the southern peninsula of Michigan, whence it flows in a general southwesterly direction until it enters Lake Michigan near the city of Muskegon.

From the vicinity of Evart to Newaygo the Muskegon flows between high banks and has a rapid fall. Levels run for the purpose show that within a distance of 10 miles—5 miles each way from Big Rapids—there is a total fall of 104 feet, practically all of which could be economically developed, as there are favorable sites for the location of dams.

In connection with power development good opportunities exist for the conservation of flow by artificial storage. The water surface areas of the principal lakes of the watershed and of the tributary drainage which they control are given below:

Drainage and surface areas of lakes in Muskegon River watershed.

Lake.	Drainage area.	Water surface.
	Sq. miles.	*Sq. miles.*
Muskrat Lake and group	57	8.0
Clam Lakes	67	6.7
Higgins Lake	67	15.0
Houghton Lake	185	31.0
Higgins and Houghton lakes	252	46.0

In the upper portion of the watershed there is a total lake area of about 110 square miles. Formerly a lumberman's dam was maintained for the purpose of flooding logs between Higgins and Houghton lakes, but this has been washed out. A lumberman's dam, built of logs and earth, which still remains about 1 mile below the foot of Houghton Lake, raises the water level in that lake 4 feet, providing a storage of 3,350,000,000 cubic feet in round numbers.

MUSKEGON RIVER AT NEWAYGO, MICH.

This station was established in March, 1901. It is located at the dam of the Newaygo Portland Cement Company, which crosses the Muskegon in a deep valley above the village of Newaygo. The conditions at this station are described in Water-Supply Paper No. 170, page 32, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Muskegon River at Newaygo, Mich., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,970	2,237	1,389	2,244	977	1,050	1,082	881	894	1,408	1,387	3,417
2	2,172	1,748	1,309	2,246	1,085	1,148	1,059	1,073	926	1,113	1,418	2,837
3	2,154	2,128	1,190	2,165	1,607	1,233	1,103	884	878	971	1,469	2,488
4	2,115	2,273	1,302	2,098	1,784	1,143	1,188	910	840	1,137	1,243	2,063
5	1,872	2,314	648	2,917	999	1,204	1,103	814	857	984	1,412	1,951
6	1,899	2,172	777	2,133	1,502	1,191	1,100	926	937	1,038	1,226	1,783
7	2,049	2,139	851	2,051	1,555	1,142	1,074	927	852	1,068	1,257	1,631
8	1,971	2,019	777	2,117	1,624	1,188	1,098	945	913	1,344	1,289	1,102
9	1,793	2,041	1,124	3,240	1,453	1,212	984	1,043	868	1,319	1,223	1,292
10	1,795	1,681	1,567	3,549	1,472	1,066	1,114	1,461	830	1,189	1,262	1,129
11	2,017	1,576	1,552	2,016	1,050	1,067	1,050	849	789	1,158	1,179	1,414
12	1,981	1,767	1,605	1,788	977	949	958	946	982	1,158	1,169	1,315
13	2,202	2,202	1,529	1,912	1,015	1,208	1,162	878	876	1,225	1,181	1,366
14	1,953	1,650	1,277	1,836	1,634	1,020	954	891	734	1,249	1,101	2,233
15	2,323	1,456	1,049	2,360	984	1,066	1,122	910	994	1,105	1,208	.....
16	3,062	2,145	1,606	2,413	1,027	1,270	1,061	1,010	990	1,120	1,204	.....
17	2,584	1,896	2,017	2,349	1,082	1,143	1,027	833	926	1,067	1,240	2,613
18	2,793	1,927	609	2,268	1,388	1,111	1,150	860	990	1,258	1,333	2,344
19	2,662	1,859	1,528	2,080	1,130	947	1,187	926	878	1,233	2,207	1,851
20	2,699	2,598	907	1,291	1,083	1,178	1,181	830	782	1,196	2,256	2,164
21	.....	2,577	1,946	1,284	1,115	1,176	1,102	963	1,365	1,286	2,151	2,172
22	.....	1,317	1,931	1,145	1,090	1,082	989	896	1,209	1,281	2,570	2,038
23	.....	1,294	1,627	1,079	958	1,147	1,062	838	1,322	1,186	3,055	1,688
24	.....	1,381	1,498	1,048	1,136	1,227	829	901	1,207	1,164	2,615	1,722
25	.....	1,652	1,525	912	1,255	1,082	1,014	846	906	1,313	2,628	1,805
26	.....	1,482	1,350	1,145	1,260	1,068	1,064	854	1,144	1,376	3,196	1,511
27	2,614	1,413	1,208	1,248	1,387	1,075	1,167	842	1,015	1,345	4,070	1,929
28	2,218	929	2,427	1,228	1,484	1,098	1,060	881	1,081	1,686	3,891	1,789
29	2,226	.....	2,374	907	1,223	1,002	1,104	812	1,191	1,835	3,648	1,909
30	2,109	.....	2,551	1,149	1,422	1,036	1,082	780	1,728	1,606	3,610	1,795
31	2,243	.....	2,722	.....	1,127	.....	1,159	926	.....	1,418	.....	1,880

NOTE.—Ice conditions January 21 to 26.

Monthly discharge of Muskegon River at Newaygo, Mich., for 1906.

[Drainage area, 2,350 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January (25 days)	3,060	1,790	2,220	0.945	0.88
February	2,600	929	1,850	.787	.82
March	2,720	609	1,480	.630	.73
April	3,550	907	1,870	.796	.89
May	1,780	958	1,250	.532	.61
June	1,270	947	1,120	.477	.53
July	1,190	829	1,080	.460	.53
August	1,460	780	914	.389	.45
September	1,730	734	997	.424	.47
October	1,840	971	1,250	.532	.61
November	4,070	1,100	1,960	.834	.93
December (29 days)	3,420	1,100	1,920	.817	.94

MANISTEE RIVER BASIN.

DESCRIPTION OF BASIN.

Manistee River is the northernmost of the group of three large rivers draining the western part of the southern peninsula of Michigan. It has its source in southeastern Antrim County, flows in a general southwesterly direction, and enters Lake Michigan at the city of Manistee, an important lumber center. The harbor at the mouth of the river is excellent. The fall is gradual and no important utilization of the water power has been made, the principal use of the stream being for rafting logs.

MANISTEE RIVER NEAR SHERMAN, MICH.

This station was established July 10, 1903, at North Bridge, near Sherman. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 34, where are given also references to publications that contain data for previous years.

A measurement was made June 30, 1906, by Horton and Covert, with the following results:

Width, 68 feet; area, 409 square feet; gage height, 2.36 feet; discharge, 988 second-feet.

Daily gage height, in feet, of Manistee River near Sherman, Mich., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.88	3.02	3.55	3.30	2.65	2.75	2.28	1.92	2.18	2.00	3.65
2	.....	2.58	2.92	3.80	3.50	2.65	2.80	2.28	1.98	2.15	2.00	3.32
3	.....	2.28	2.80	4.02	3.60	2.62	2.65	2.35	2.12	2.10	2.00	3.00
4	.....	2.35	2.80	4.35	3.80	2.60	2.45	2.30	2.15	2.02	2.00	2.72
5	.....	2.42	2.72	4.58	3.98	2.62	2.40	2.20	2.10	1.95	2.00	2.70
6	.....	2.45	2.70	4.68	3.78	2.65	2.40	2.12	2.08	1.95	2.00	2.65
7	.....	2.42	2.70	4.62	3.55	2.72	2.35	2.10	2.05	1.95	2.00	2.60
8	.....	2.32	2.68	4.60	3.50	2.72	2.30	2.10	2.00	1.95	2.00	2.60
9	.....	2.45	2.68	4.65	3.40	2.68	2.30	2.12	2.00	2.00	2.00	2.52
10	.....	4.00	2.70	4.85	3.32	2.58	2.30	2.12	1.98	2.02	2.05	2.48
11	.....	5.00	2.70	5.05	3.22	2.50	2.30	2.10	1.95	2.10	2.00	2.42
12	.....	4.68	2.68	5.15	3.18	2.42	2.30	2.10	1.92	2.08	2.00	2.52
13	.....	4.00	2.58	5.05	3.18	2.32	2.30	2.02	1.92	2.05	2.00	2.55
14	.....	3.50	2.50	5.00	3.22	2.30	2.30	2.00	1.95	2.05	2.00	2.48
15	.....	3.15	2.45	4.92	3.25	2.30	2.45	2.00	2.00	2.05	2.08	2.40
16	.....	3.02	2.45	4.90	3.22	2.30	2.80	2.00	2.00	2.05	2.10	2.38
17	.....	3.00	2.38	4.88	3.12	2.35	2.95	1.98	1.98	2.05	2.10	2.35
18	.....	3.05	2.28	4.68	3.08	2.40	3.00	1.92	1.95	2.05	2.18	2.35
19	.....	3.40	2.30	4.35	3.08	2.40	3.00	2.05	1.95	2.10	2.22	2.42
20	2.65	3.35	2.35	4.15	3.10	2.40	2.85	2.18	1.90	2.10	2.35	2.30
21	3.35	2.80	2.32	4.10	2.95	2.45	2.55	2.15	1.92	2.08	2.55	2.30
22	4.15	2.60	2.25	4.10	2.82	2.60	2.35	2.10	1.90	2.10	2.75	2.30
23	4.28	2.95	2.18	4.12	2.72	2.55	2.30	2.10	1.90	2.10	2.95	2.30
24	4.05	3.45	2.08	4.08	2.70	2.50	2.30	2.10	1.90	2.10	3.08	2.30
25	4.78	3.70	2.18	3.98	2.70	2.50	2.25	2.10	1.90	2.10	3.22	2.30
26	4.45	3.58	2.40	3.75	2.70	2.40	2.22	2.10	1.90	2.12	3.35	2.30
27	4.00	3.38	2.78	3.65	2.72	2.40	2.32	2.10	1.90	2.15	3.55	2.30
28	3.42	3.15	3.12	3.45	2.80	2.40	2.35	2.10	1.90	2.15	3.68	2.30
29	3.12	.....	3.18	3.40	2.80	2.40	2.35	2.10	2.20	2.10	3.75	2.25
30	3.02	.....	3.25	3.32	2.80	2.35	2.35	2.10	2.20	2.08	3.78	2.22
31	2.98	.....	3.45	.....	2.65	.....	2.30	2.00	.....	2.00	.....	2.32

NOTE.—On February 1 a jam of logs several miles below the station stopped the flow of slush ice, which backed up several miles above the gage and froze; this ice went out February 17.

LAKE HURON DRAINAGE.

GENERAL FEATURES.

The area tributary to Lake Huron in the United States comprises the eastern part of the southern peninsula of Michigan. South of Saginaw Bay the Lake Huron slope is very narrow and the brooks and runnels by which it is drained are only a few miles in length. The so-called Thumb of the Mitten is drained chiefly by three short, northward-flowing streams known as Willow, Pinnepog, and Pigeon rivers, which lie in a flat, marshy region. The Saginaw River system is tributary to the bay at its head, while northward from the bay are Rifle, Au Sable, and Thunder Bay rivers, streams having considerable fall, excellent ground storage, and well-sustained flow. Cheboygan River also belongs in the Lake Huron drainage.

AU SABLE RIVER BASIN.

DESCRIPTION OF BASIN.

Au Sable River rises in southern Otsego County and follows a tortuous course in a general southeasterly direction to its outlet in Lake Huron at Oscoda, Mich. Numerous small lakes, wet sand areas, and undrained hollows occur. Rock outcrops are very rare, the stream bed being usually clay or sand. The tributaries are unimportant, nearly all the rainfall being absorbed by the porous sand areas. At Bamfield, about 40 miles from the outlet, following the river, the elevation is about 850 feet above sea level, and from this point to the mouth of the stream excellent sites for water-power development occur.

AU SABLE RIVER AT BAMFIELD, MICH.

This station was established August 27, 1902. It is located at the highway bridge at Bamfield. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 38, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Au Sable River at Bamfield, Mich., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.0	1.6	1.8	2.5	2.0	1.8	2.0	1.5	1.1	1.1	1.1	2.9
2	1.0	1.6	1.7	2.7	2.0	1.8	1.1	1.2	1.1	1.1	1.2	2.95
3	1.1	1.4	1.7	2.95	2.0	1.8	1.1	1.1	1.2	1.1	1.2	3.05
4	1.1	1.4	1.7	3.25	2.0	1.9	1.1	1.05	1.1	1.1	1.3	3.0
5	1.0	1.4	1.6	3.6	2.0	1.8	1.1	1.05	1.1	1.1	1.2	3.2
6	1.0	2.5	1.6	3.65	2.1	1.8	1.1	1.05	1.1	1.2	1.3	3.15
7	1.0	2.2	1.6	2.9	2.0	1.8	1.1	1.05	1.1	1.2	1.2	3.1
8	1.0	2.6	1.5	3.0	2.0	1.8	1.1	1.5	1.1	1.2	1.3	3.1
9	0.9	3.0	1.5	3.1	2.1	1.8	1.1	1.5	1.1	1.1	1.3	3.0
10	0.9	2.4	1.5	3.5	2.0	1.8	2.0	1.5	1.0	1.1	1.3	3.0

Daily gage height, in feet, of Au Sable River at Bamfield, Mich., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	0.9	2.4	1.4	3.9	2.0	1.8	1.9	1.5	1.0	1.1	1.2	3.1
12	0.9	2.4	1.4	3.45	1.95	1.8	1.4	1.4	1.0	1.1	1.3	3.0
13	0.9	2.4	1.3	3.45	2.05	1.7	1.4	1.4	1.0	1.1	1.2	2.9
14	0.9	2.4	1.3	3.65	2.0	1.5	1.4	1.3	1.1	1.1	1.3	2.8
15	1.0	2.3	1.2	3.65	2.0	1.5	1.9	1.3	1.0	1.1	1.3	2.8
16	1.1	2.2	1.2	3.45	2.0	1.5	1.9	1.1	1.0	1.1	1.35	2.8
17	1.1	2.0	1.2	3.0	2.1	2.3	1.9	1.1	1.0	1.2	1.55	2.8
18	1.1	2.2	1.1	3.05	1.9	2.3	2.0	1.1	1.0	1.4	1.85	2.6
19	1.0	2.6	1.1	2.5	1.9	2.1	1.5	1.1	1.0	1.5	2.5	2.5
20	1.1	2.7	1.2	2.5	1.9	2.1	1.5	1.1	1.0	1.4	2.7	2.6
21	1.3	2.7	1.2	2.7	1.9	2.0	1.5	1.3	1.0	1.3	2.75	3.0
22	1.4	2.8	1.2	2.7	1.9	1.9	1.4	1.3	1.0	1.3	2.8	3.5
23	2.4	2.8	1.2	2.65	1.9	1.9	1.2	1.2	1.0	1.3	2.7	4.1
24	2.75	2.8	1.2	2.55	1.9	1.9	1.2	1.1	1.0	1.2	2.7	4.35
25	2.2	3.0	1.4	2.45	2.0	1.95	1.1	1.2	1.0	1.3	2.6	5.0
26	2.3	2.8	1.5	2.45	1.9	2.0	1.1	1.2	1.0	1.2	2.6	5.0
27	2.0	2.0	1.8	2.0	1.9	2.0	1.1	1.4	1.0	1.2	2.55	5.0
28	1.55	1.9	1.9	2.0	1.9	2.2	1.4	1.2	1.0	1.1	2.65	4.8
29	1.6	.....	1.7	2.2	1.9	2.0	1.5	1.1	1.1	1.2	2.65	4.2
30	1.6	.....	2.0	1.9	1.9	2.0	2.2	1.1	1.2	1.0	2.8	4.1
31	1.6	.....	2.5	.....	1.9	.....	1.5	1.1	.....	1.0	.....	2.85

Rating table for Au Sable River at Bamfiela, Mich., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	1,050	1.70	1,460	2.50	1,960	3.60	2,810
1.00	1,100	1.80	1,520	2.60	2,040	3.80	2,970
1.10	1,140	1.90	1,570	2.70	2,110	4.00	3,130
1.20	1,200	2.00	1,630	2.80	2,190	4.20	3,300
1.30	1,240	2.10	1,700	2.90	2,200	4.40	3,480
1.40	1,300	2.20	1,760	3.00	2,340	4.60	3,650
1.50	1,340	2.30	1,830	3.20	2,490	4.80	3,840
1.60	1,400	2.40	1,900	3.40	2,650	5.00	4,020

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1902–1905, and is well defined below gage height 3.5 feet.

Monthly discharge of Au Sable River at Bamfield, Mich., for 1906.

[Drainage area, 1,420 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	2,150	1,050	1,270	0.894	1.03
February	2,340	1,300	1,850	1.30	1.35
March	1,960	1,140	1,350	.951	1.10
April	3,050	1,570	2,280	1.61	1.80
May	1,700	1,570	1,610	1.13	1.30
June	1,830	1,340	1,570	1.11	1.24
July	1,760	1,140	1,320	.930	1.07
August	1,340	1,120	1,210	.852	.98
September	1,200	1,100	1,120	.789	.88
October	1,340	1,100	1,180	.831	.96
November	2,190	1,140	1,580	1.11	1.24
December	4,020	1,960	2,660	1.87	2.16
The year	4,020	1,050	1,580	1.11	15.11

NOTE.—Values are rated as excellent except in February, the figures for which are probably considerably in excess of the true flow on account of ice conditions.

RIFLE RIVER BASIN.

DESCRIPTION OF BASIN.

Rifle River rises in the vicinity of Rose City, in northern Ogemaw County, flows southward and southeastward, and empties into Saginaw Bay about 5 miles below Omer, Arenac County. Its basin, covering about 385 square miles, is long and narrow, having a width of about 3 miles at the mouth of the stream. The basin contains numerous small glacial lakes, but there is no controlled storage and a very small percentage of natural water surface. Ramifying tributaries at the headwaters give the stream a relatively large volume at the entrance of West Branch, in T. 21 N., R. 3 E. The region is wild and the stream is undeveloped, but it is being exploited with a view to the transmission of electric power to Saginaw and Bay City.

RIFLE RIVER NEAR STERLING, MICH.

This station was established November 14, 1905. It is located near Sterling, at Meeker's bridge, in sec. 5, T. 19 N., R. 5 E., and is about 4 miles upstream from Omer, where a gaging station was formerly maintained. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 40.

A measurement was made June 18, 1906, by Horton and Covert, with the following results:

Width, 51 feet; area, 140 square feet; gage height, 1.70 feet; discharge, 262 second-feet.

Daily gage height, in feet, of Rifle River near Sterling, Mich., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.40	3.35	5.10	5.50	2.38	1.87	2.80	1.39	1.38	1.80	1.85	2.85
2	2.28	2.85	4.70	5.38	2.32	1.82	2.52	1.38	1.38	1.72	1.77	2.58
3	2.46	3.65	4.71	5.48	2.29	1.78	2.29	1.36	1.48	1.52	1.70	2.32
4	2.65	3.70	5.11	5.65	2.22	1.78	2.10	1.30	1.42	1.47	1.66	1.98
5	2.56	3.82	4.95	5.40	2.11	2.00	2.00	1.28	1.40	1.48	1.70	2.08
6	2.49	4.05	4.72	4.68	2.08	1.94	1.70	1.28	1.36	1.45	1.79	2.14
7	2.50	3.65	4.65	4.43	2.04	2.02	1.70	1.40	1.28	1.51	1.64	2.41
8	2.50	3.69	4.48	4.30	2.00	2.28	1.61	1.41	1.32	1.50	1.64	3.15
9	2.60	3.58	4.65	5.25	2.26	2.12	1.60	1.38	1.25	1.55	1.54	3.40
10	2.80	3.35	4.70	6.12	2.25	1.95	1.62	1.36	1.24	1.51	1.60	3.70
11	2.72	3.22	4.55	6.65	2.20	2.32	1.57	1.31	1.26	1.44	1.70	3.25
12	2.75	3.31	4.40	4.99	2.35	1.71	1.58	1.29	1.23	1.46	1.58	3.35
13	2.58	3.48	4.21	4.50	3.35	1.66	1.53	1.26	1.32	1.40	1.50	3.45
14	2.74	3.35	4.05	5.10	3.25	1.65	1.42	1.24	1.26	1.40	1.51	3.15
15	2.72	3.34	3.78	6.65	2.84	1.60	1.42	1.22	1.24	1.33	1.58	3.10
16	3.09	3.38	3.88	6.20	2.65	1.62	1.80	1.25	1.33	1.38	1.50	2.85
17	3.10	3.42	3.45	4.65	3.10	1.72	1.70	1.22	1.31	1.40	1.61	2.50
18	2.96	3.50	3.52	4.18	3.12	1.72	1.59	1.21	1.24	1.40	2.01	2.50
19	3.01	3.55	3.65	3.85	2.72	1.72	1.55	1.26	1.23	1.75	2.36	2.24
20	2.95	3.60	3.65	3.50	2.40	1.69	1.50	1.45	1.24	1.80	2.26	2.22
21	3.50	4.50	3.46	3.18	2.30	1.70	1.60	1.76	1.31	1.76	2.18	2.55
22	5.25	4.54	3.45	3.03	2.14	1.72	1.55	1.65	1.45	1.64	3.75	2.54
23	6.20	4.48	3.50	3.20	2.09	1.70	1.51	1.86	1.49	1.54	3.65	2.32
24	5.20	5.35	3.45	3.03	2.01	1.61	1.48	2.15	1.47	1.65	3.00	2.18
25	4.60	6.64	3.34	2.93	1.94	1.54	1.39	1.76	1.32	2.01	2.55	2.25

Daily gage height, in feet, of Rifle River near Sterling, Mich., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26	4.32	6.65	3.90	2.74	2.08	1.56	1.30	1.78	1.27	2.05	3.48	2.42
27	4.12	5.90	5.92	2.53	2.18	2.15	1.37	2.04	1.32	2.22	5.14	2.47
28	4.08	5.44	5.84	2.44	2.15	2.65	1.50	1.80	1.27	2.40	4.14	2.36
29	3.78	.....	6.40	2.62	1.96	2.75	1.52	1.64	1.90	2.29	3.55	2.41
30	3.68	.....	6.79	2.52	1.91	2.50	1.58	1.48	2.30	2.15	3.10	2.45
31	3.58	.....	7.20	.....	1.90	.....	1.51	1.41	.....	2.00	.....	4.08

NOTE.—The following ice conditions prevailed during 1906: January 15, ice along both shores, open channel in midstream above and below gage; January 31, ice along both shores from 4 to 10 inches thick, channel open; February 15, river frozen at gage, open above and below, ice 12 inches thick; February 28, river frozen at gage, open above and below, ice 10 inches thick; March 15, river frozen at gage, small hole open above and below the section, ice 12 inches thick; March 31, ice all gone.

SAGINAW RIVER BASIN.

DESCRIPTION OF BASIN.

Three streams—Tittabawassee, Shiawassee, and Cass rivers—unite near Saginaw to form Saginaw River, the combined catchment areas receiving the drainage from a crescent-shaped region of about 6,000 square miles surrounding Saginaw Bay.

Tittabawassee River, the northernmost of the three, drains a relatively flat region. From railroad profiles it is estimated that the fall of the stream from Highwood to its mouth, a distance of about 50 miles along the river, is 140 feet.

TITTABAWASSEE RIVER AT FREELAND, MICH.

This station was established August 22, 1903, discontinued August 3, 1906, and reestablished October 28, 1906. It is located at the Freeland highway bridge, 10 miles northwest of Saginaw, in sec. 21, T. 13 N., R. 3 E., one-half mile from Freeland. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 42, where are given also references to publications that contain data for previous years.

Discharge measurements of Tittabawassee River at Freeland, Mich., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 21	D. L. Mott	238	2,030	5.58	4,420
June 19	Covert and Horton	213	927	2.08	764

Daily gage height, in feet, of Tittabawassee River at Freeland, Mich., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Oct.	Nov.	Dec.
1	3.62	7.98	13.22	8.58	3.60	3.18	2.38	1.74	.....	3.0	6.5
2	3.62	7.38	12.32	7.80	3.52	2.90	2.00	1.78	.....	2.8	6.25
3	3.58	6.68	11.50	7.45	3.52	2.72	1.98	2.00	.....	2.75	6.0
4	3.52	6.05	11.85	7.60	3.45	2.58	1.90	.....	.....	2.6	5.9
5	3.49	5.95	12.45	7.65	3.28	2.50	1.85	.....	.....	2.6	5.15

Daily gage height, in feet, of Tittabawassee River at Freeland, Mich., in 1906—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Oct.	Nov.	Dec.
6	3.42	5.82	12.20	7.48	3.12	2.52	1.90	.....	.....	2.55	4.85
7	3.32	5.78	11.68	6.02	3.00	2.52	1.95	.....	.....	2.5	5.2
8	3.29	5.65	11.22	6.52	2.88	2.62	1.82	.....	.....	2.45	5.6
9	3.25	5.60	11.00	7.55	3.30	2.75	1.72	.....	.....	2.4	6.0
10	3.22	5.48	10.95	10.43	3.22	2.88	1.68	.....	.....	2.3	6.2
11	3.19	5.18	10.52	10.60	3.35	2.75	1.72	.....	.....	2.2	6.45
12	3.15	4.92	10.05	9.70	3.48	2.48	1.62	.....	.....	2.2	6.8
13	3.12	4.60	9.38	8.85	3.80	2.28	1.50	.....	.....	2.15	6.95
14	3.10	4.48	8.92	8.75	5.20	2.18	1.55	.....	.....	2.1	7.2
15	3.18	4.40	8.62	10.50	5.00	2.08	1.68	.....	.....	2.1	7.35
16	3.40	4.22	8.22	11.30	5.15	2.00	1.75	.....	.....	2.0	7.8
17	3.92	4.00	7.92	10.00	4.65	2.00	1.82	.....	.....	2.0	7.75
18	4.58	4.08	7.62	8.42	4.32	2.00	1.92	.....	.....	2.2	7.0
19	4.08	4.18	7.42	7.30	3.80	1.75	1.78	.....	.....	3.8	6.4
20	4.22	4.30	7.30	6.18	3.10	2.00	1.68	.....	.....	4.05	5.3
21	5.70	6.40	7.45	5.62	2.85	2.00	1.70	.....	.....	5.3	4.95
22	10.08	8.90	7.12	5.28	2.70	2.00	1.65	.....	.....	6.8	4.5
23	13.70	9.95	6.72	5.02	2.60	2.00	1.62	.....	.....	7.1	4.1
24	14.62	10.20	6.38	4.88	2.78	2.05	1.58	.....	.....	6.45	3.9
25	14.20	11.05	6.62	4.65	2.95	2.00	1.50	.....	.....	5.2	3.75
26	13.65	14.90	7.30	4.40	3.38	2.00	1.51	.....	.....	5.85	3.5
27	13.18	14.95	10.65	4.32	3.65	2.08	1.50	.....	.....	6.9	3.45
28	12.30	13.90	13.48	3.85	3.88	2.12	1.58	.....	2.6	7.0	3.35
29	10.98	.....	12.20	3.82	4.05	2.18	1.75	.....	3.0	6.95	3.3
30	9.90	.....	9.90	3.72	3.82	2.10	1.74	.....	3.2	6.9	3.25
31	8.82	.....	9.18	.....	3.45	.....	1.70	.....	3.6	.....	6.0

NOTE.—Ice conditions probably affected the flow to some extent from January 21 to March 29. The high stages during this period were caused by ice jams. The ice passed out at noon, March 29.

LAKE ERIE DRAINAGE.

GENERAL FEATURES.

That portion of the Lake Erie drainage basin that lies within the United States, exclusive of Lakes Superior, Michigan, and Huron, covers the northern third of Ohio, a small corner of northeastern Indiana, and a similar area in southeastern Michigan. South of the lake the drainage area is narrow, the divide lying in places scarcely 50 miles back from the lake shore. To the west the width of the area is greater, and the Maumee, which enters the lake near Toledo, is the largest stream of northern Ohio. The average altitude of the watershed above Lake Erie is 500 feet, but the head of the Maumee at Fort Wayne, Ind., is only 170 feet above the lake. The surface is level or gently rolling.

The principal streams are Huron and Raisin rivers, which enter the lake from the Michigan corner, and Maumee, Black, and Cuyahoga rivers, which enter from Ohio. Of these, the Maumee, formed by the junction of St. Marys and St. Joseph rivers at Fort Wayne, Ind., is the most important.

HURON RIVER BASIN.

DESCRIPTION OF BASIN.

Huron River rises near the central part of Oakland County, Mich., flows southwestward, then southeastward, and is tributary to the west end of Lake Erie near the mouth of Detroit River. The Huron receives the drainage from an irregularly shaped basin having its greatest length parallel to and lying at a distance of 25 to 30 miles from Detroit River. This basin is connected with Lake Erie by a long, narrow valley, averaging 5 miles in width, extending from a point near Ypsilanti southeastward to Lake Erie, a distance of 28 miles. In this portion of its course a large part of the total fall of the river occurs. The conditions are thus nearly ideal for the development of water power, in that nearly the entire catchment area, all the large tributaries, and an extensive area affording lake and ground storage lie above the head of this narrow valley.

The northern portion of the main catchment area is rolling and its topography is complex. The stream flows through a series of lakes, and north of Dover the entire basin is largely composed of lakes and surrounding marshes. In the vicinity of Ann Arbor the topography is very rolling. The stream has here a broad, flat valley, bordered by abrupt hills ranging in height from 100 to 200 feet. The channel is tortuous and changeable. Numerous abandoned sections remain as bayous. Large springs issue from the morainal hills.

Below Ypsilanti the drainage basin is flat, the soil, comparatively heavy and impervious, is mostly under cultivation, and the ground-water level is controlled by numerous drain trenches.

HURON RIVER AT DEXTER, MICH.

This station was established September 1, 1904. It is located just above the highway bridge in the village of Dexter. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 44, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Huron River at Dexter, Mich., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.40	2.52	1.60	2.08	1.40	1.42	0.90	1.25	0.85	0.90	1.20	1.40
2	1.40	2.42	1.60	2.40	1.45	1.32	.90	1.15	.85	.85	1.20	1.35
3	1.45	2.30	2.05	2.00	1.42	1.22	.90	1.10	.80	.85	1.15	1.35
4	1.60	2.12	2.15	1.95	1.40	1.20	.90	1.10	.80	.85	1.15	1.3
5	1.52	2.00	1.98	1.90	1.35	1.15	1.00	1.08	.80	.95	1.15	1.35
6	1.45	1.92	1.90	1.90	1.35	1.15	.95	1.08	.75	.95	1.15	1.80
7	1.35	1.82	1.85	1.85	1.30	1.25	.95	1.00	.75	.95	1.15	2.00
8	1.40	1.68	1.80	1.80	1.25	1.52	.95	1.00	.70	.95	1.15	1.98
9	1.40	1.58	1.78	2.10	1.40	1.75	.95	1.00	.70	1.00	1.12	1.88
10	1.40	1.48	1.75	2.20	1.35	1.80	.95	1.05	.70	1.00	1.10	1.82

Daily gage height, in feet, of Huron River at Dexter, Mich., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	1.35	1.38	1.72	2.18	1.30	1.72	0.95	1.08	0.70	1.00	1.10	[illegible]
12	1.35	1.35	1.70	2.10	1.30	1.62	.95	1.00	.70	1.00	1.05	[illegible]
13	1.30	1.35	1.70	2.08	1.30	1.52	.95	.95	.70	1.00	1.05	[illegible]
14	1.30	1.35	1.65	2.30	1.80	1.42	.95	.90	.65	1.00	1.05	[illegible]
15	1.35	1.35	1.60	2.60	2.20	1.35	.92	.90	.65	1.00	1.05	[illegible]
16	1.65	1.32	1.55	2.55	1.90	1.30	.90	.90	.65	.95	1.05	[illegible]
17	1.58	1.30	1.52	2.48	1.70	1.30	.90	.85	.65	.95	1.08	[illegible]
18	1.50	1.28	1.42	2.32	1.52	1.30	.85	.82	.65	.95	1.10	[illegible]
19	1.50	1.20	1.42	2.22	1.50	1.30	.85	.80	.65	.95	1.10	[illegible]
20	1.70	1.20	1.38	2.12	1.42	1.30	.80	.80	.65	.95	1.15	[illegible]
21	2.50	1.40	1.32	1.98	1.32	1.25	.80	.80	.65	.90	1.35	[illegible]
22	3.30	1.40	1.30	1.88	1.30	1.20	.80	.80	.68	.90	1.50	[illegible]
23	3.40	1.40	1.30	1.80	1.35	1.20	.90	.80	.70	.90	1.50	[illegible]
24	3.35	1.45	1.28	1.75	1.50	1.15	.88	.80	.70	.92	1.50	[illegible]
25	3.25	1.80	1.25	1.70	1.42	1.15	.82	.80	.68	1.00	1.50	[illegible]
26	3.05	1.80	1.32	1.68	1.35	1.10	.80	.85	.65	1.02	1.50	[illegible]
27	2.98	1.72	2.10	1.62	1.40	1.10	.75	.85	.65	1.10	1.50	[illegible]
28	2.92	1.65	2.48	1.58	1.85	1.05	.75	.85	.65	1.15	1.48	[illegible]
29	2.82	.....	2.40	1.55	1.88	1.00	1.15	.85	.75	1.15	1.45	[illegible]
30	2.72	.....	2.28	1.45	1.75	.95	1.48	.85	.88	1.15	1.42	[illegible]
31	2.62	.....	2.18	.....	1.55	.....	1.38	.80	.....	1.20	.....	[illegible]

HURON RIVER AT GEDDES, MICH.

A record of the depth of overflow at the dam and of the run of the water wheels in the adjacent electric plant has been maintained at Geddes by the Washtenaw Electric Company since February 1, 1904. The conditions at this station are described in Water-Supply Paper No. 170, page 45, where are given also references to publications that contain data for previous years.

Monthly discharge of Huron River at Geddes, Mich., for 1906.

[Drainage area, 757 square miles.]

Month.	Mean discharge in second-feet.	Run-off.	
		Sec.-ft. per sq. mile.	Depth in inches.
January	686	0.906	[illegible]
February	426	.563	[illegible]
March	515	.680	[illegible]
April	620	.819	[illegible]
May	454	.600	[illegible]
June	322	.425	[illegible]
July	148	.196	[illegible]
August	156	.206	[illegible]
September	83.6	.110	[illegible]
October	139	.184	[illegible]
November	272	.359	[illegible]
December	447	.591	[illegible]
The year	356	.470	[illegible]

HURON RIVER AT FLATROCK, MICH.

This station was established August 6, 1904. It is located at the highway bridge below Metler's dam at Flatrock, Mich., about 8 miles above the mouth of the stream. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page

47, where are given also references to publications that contain data for previous years.

Discharge measurements of Huron River at Flatrock, Mich., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 23	D. L. Mott	100	430	3.68	944
June 15	Horton and Covert	100	270	2.22	509

Daily gage height, in feet, of Huron River at Flatrock, Mich., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	4.85	2.8	4.1	2.8	2.6	1.25	1.9	1.0	1.05	1.7	2.3
2	.....	4.35	3.0	4.0	2.65	2.25	1.15	1.65	.7	.....	1.8	2.1
3	.....	5.65	3.0	4.1	2.7	2.05	1.0	1.35	1.05	1.1	1.85	2.05
4	.....	6.0	4.4	3.9	2.65	1.75	1.6	1.35	.85	1.3	1.65	2.1
5	.....	5.7	4.5	3.85	2.7	1.9	1.45	1.35	1.15	1.0	1.6	1.9
6	.....	5.3	4.0	3.9	2.4	1.75	2.25	1.1	1.1	1.1	1.85	3.45
7	.....	5.1	3.8	3.8	2.1	1.75	2.05	1.55	1.0	1.2	1.75	4.9
8	.....	5.0	3.6	3.65	2.35	1.6	1.5	1.4	.85	1.3	1.65	4.8
9	.....	4.85	3.65	3.8	2.2	3.15	1.0	1.35	.85	1.4	1.55	4.2
10	.....	4.65	3.55	4.6	2.35	3.85	1.5	1.35	.85	1.3	1.45	3.85
11	.....	4.05	3.5	4.55	2.45	3.35	1.4	1.4	.7	1.25	1.5	3.5
12	.....	3.6	3.35	4.5	2.25	3.25	1.4	1.3	1.0	1.35	1.5	3.25
13	.....	3.95	3.4	4.25	2.15	2.95	1.25	1.25	.75	1.35	1.6	3.15
14	.....	3.6	3.15	4.2	3.25	2.65	1.25	1.5	.7	1.15	1.5	3.4
15	.....	3.45	3.05	4.9	4.5	2.35	1.05	1.4	.8	1.15	1.5	3.75
16	.....	3.0	2.85	5.3	4.5	2.2	1.1	1.0	.7	1.25	1.45	3.75
17	.....	3.05	2.7	5.15	4.35	2.25	1.15	1.05	.65	1.2	1.25	3.45
18	.....	3.0	2.65	4.65	3.6	2.05	1.25	.95	.6	1.2	1.4	3.2
19	.....	2.8	2.45	4.25	3.0	2.35	1.15	1.0	.85	1.25	1.6	2.65
20	3.1	3.3	2.65	4.05	2.55	2.0	1.0	.95	.75	1.15	1.75	3.7
21	3.75	3.3	2.4	3.95	2.35	2.0	1.1	1.0	.8	1.1	2.35	5.15
22	5.85	3.6	2.4	3.8	2.5	1.85	.95	1.15	.65	1.05	3.0	5.65
23	6.85	3.5	2.25	3.6	2.1	1.65	1.0	1.1	.6	1.2	3.2	4.1
24	7.05	3.2	1.85	3.6	2.15	1.7	1.25	1.2	.85	1.3	3.0	4.1
25	6.45	3.0	2.15	3.3	2.3	1.3	1.2	1.4	.7	1.35	2.6	4.3
26	5.9	3.4	2.05	3.25	2.4	1.8	1.05	1.1	.65	1.35	2.7	4.2
27	5.55	3.75	3.45	3.2	2.25	1.65	1.1	1.05	.8	1.3	2.65	4.25
28	5.4	3.4	5.1	2.9	2.3	1.45	1.15	1.1	.75	1.35	2.5	4.15
29	5.3	.....	5.0	2.85	3.3	1.25	1.35	1.3	.85	1.5	2.35	3.7
30	5.3	.....	4.85	2.7	3.6	1.35	1.8	1.15	1.05	1.9	2.35	3.5
31	5.05	.....	4.35	.....	3.05	.....	2.05	1.1	.....	1.75	.....	4.65

NOTE.—The flow is somewhat affected by ice during the winter months; slush ice is noted on February 3 and anchor ice on March 21.

Rating table for Huron River at Flatrock, Mich., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.60	141	1.90	401	3.20	722	5.00	1,261
0.70	158	2.00	424	3.30	748	5.20	1,331
0.80	176	2.10	447	3.40	774	5.40	1,403
0.90	194	2.20	471	3.50	801	5.60	1,476
1.00	213	2.30	495	3.60	828	5.80	1,550
1.10	232	2.40	519	3.70	856	6.00	1,624
1.20	252	2.50	543	3.80	884	6.20	1,699
1.30	272	2.60	568	3.90	913	6.40	1,775
1.40	293	2.70	593	4.00	942	6.60	1,852
1.50	314	2.80	618	4.20	1,002	6.80	1,930
1.60	335	2.90	644	4.40	1,064	7.00	2,010
1.70	357	3.00	670	4.60	1,128	8.00	2,416
1.80	379	3.10	696	4.80	1,194		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906, and is well defined between gage heights 0.3 foot and 2.6 feet.

Monthly discharge of Huron River at Flatrock, Mich., for 1906.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
January (20-31)	2,030	696	1,450
February	1,620	618	967
March	1,300	390	758
April	1,370	593	938
May	1,100	447	617
June	898	262	462
July	483	204	277
August	401	204	263
September	242	141	180
October	401	213	259
November	722	282	419
December	1,490	401	859

NOTE.—Values are good.

MAUMEE RIVER BASIN.

DESCRIPTION OF BASIN.

Maumee River is formed at Fort Wayne, Ind., by the junction of St. Joseph and St. Marys rivers and flows northeastward into Lake Erie at Toledo. The chief tributaries are Auglaize and Tiffin rivers. The total drainage area is 6,723 square miles.

MAUMEE RIVER NEAR SHERWOOD, OHIO.

This station was established May 19, 1903, and was discontinued July 21, 1906. It is located at the highway bridge 2.5 miles south of Sherwood, Ohio, and 200 feet upstream from the Cincinnati Northern Railroad bridge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 50, where are given also references to publications that contain data for previous years.

Discharge measurements of Maumee River near Sherwood, Ohio, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec. ft.*
February 11 [a]	Brennan and Kriegsman	236	597	3.34	458
March 8	E. F. Kriegsman	248	1,060	4.57	1,920
April 5	do	266	1,540	6.51	3,360
May 12	do	242	470	2.30	482

[a] River entirely frozen over; average thickness of ice, 0.6 foot; gage height to top of ice, 3.39 feet.

Daily gage height, in feet, of Maumee River at Sherwood, Ohio, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	4.4	5.3	5.0	10.5	3.0	2.6	2.45
2	4.0	5.2	3.8	10.1	2.9	2.5	2.45
3	3.72	5.2	3.9	9.5	2.7	2.4	2.5
4	3.7	5.3	5.3	7.2	2.7	2.35	2.6
5	4.2	.....	5.8	6.5	2.6	2.3	2.6
6	4.4	.....	5.6	6.0	2.6	2.25	2.5
7	4.6	.....	5.1	5.6	2.6	2.2	2.5
8	5.0	.....	4.6	5.2	2.5	2.25	2.5
9	5.4	.....	4.2	5.2	2.4	2.4	2.5
10	5.6	.....	4.1	8.5	2.4	2.55	2.7

Daily gage height, in feet, of Maumee River at Sherwood, Ohio, for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
11	5.6	.....	4.0	7.6	2.35	2.6	3.55
12	5.6	.....	3.9	6.4	2.3	4.2	3.5
13	5.6	.....	3.8	5.8	2.25	5.2	3.3
14	5.6	.....	3.6	6.3	2.2	4.8	3.2
15	5.5	4.6	3.3	7.8	2.2	4.6	3.1
16	5.4	.....	3.2	7.2	2.15	4.4	3.0
17	5.2	.....	3.1	6.9	2.1	4.0	3.0
18	5.1	.....	3.1	6.4	2.1	3.6	3.0
19	5.3	3.5	3.0	5.9	2.5	3.35	2.95
20	6.2	.....	3.0	5.0	2.5	3.1	2.9
21	8.1	.....	2.9	4.4	2.45	3.0	2.8
22	9.0	.....	2.9	4.0	2.3	2.8	.....
23	10.7	.....	2.9	3.6	2.2	3.2	.....
24	10.1	3.2	2.8	3.3	2.15	3.0	.....
25	9.6	3.3	2.8	3.4	2.15	2.85	.....
26	9.0	3.3	2.8	4.3	2.15	2.7	.....
27	8.1	4.4	6.32	3.8	2.15	2.6	.....
28	7.3	5.3	12.8	3.4	2.15	2.55	.....
29	5.9	.....	13.0	3.3	2.2	2.5	.....
30	5.5	.....	11.6	3.2	2.3	2.5	.....
31	5.3	.....	11.2	.....	2.65	.....	.....

NOTE.—The river was frozen January 9 to 19 and February 5 to 24; ice was about 0.5 foot thick February 15 to 19.

Rating table for Maumee River near Sherwood, Ohio, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	370	3.40	1,120	4.70	2,000	7.00	3,770
2.20	425	3.50	1,180	4.80	2,070	7.20	3,930
2.30	480	3.60	1,240	4.90	2,140	7.40	4,090
2.40	535	3.70	1,300	5.00	2,210	7.60	4,270
2.50	590	3.80	1,370	5.20	2,350	7.80	4,450
2.60	645	3.90	1,440	5.40	2,490	8.00	4,630
2.70	700	4.00	1,510	5.60	2,650	9.00	5,530
2.80	760	4.10	1,580	5.80	2,810	10.00	6,470
2.90	820	4.20	1,650	6.00	2,970	11.00	7,470
3.00	880	4.30	1,720	6.20	3,130	12.00	8,570
3.10	940	4.40	1,790	6.40	3,290	13.00	9,680
3.20	1,000	4.50	1,860	6.60	3,450		
3.30	1,060	4.60	1,930	6.80	3,610		

NOTE.—The above table is applicable only for open-channel conditions. It is based on three discharge measurements made during 1906, and the form of the 1905 curve. It is well defined below gage height 6.5 feet.

Monthly discharge of Maumee River near Sherwood, Ohio, for 1906.

[Drainage area, 2,190 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January [a]	7,170	.....	2,730	1.25	1.44
February [a]	2,420	.....	1,030	.470	.49
March	9,680	760	2,400	1.10	1.27
April	6,970	1,000	2,980	1.36	1.52
May	880	370	527	.241	.28
June	2,350	425	930	.425	.47
July (1-21)	1,210	562	787	.359	.28

[a] January and February corrected for effect of ice conditions.

NOTE.—Values are rated as follows: January and February, fair; March to July, good.

ST. JOSEPH RIVER AT FORT WAYNE, IND.

This station was established March 20, 1905, and was discontinued July 20, 1906. It was located on the first highway bridge, about 1 mile above the junction with St. Marys River. The gage was read during 1906 by S. F. Mills. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 52.

Discharge measurements of St. Joseph River at Fort Wayne, Ind., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 11 [a]	Brennan and Kriegsman	70	270	2.59	122
March 9	E. F. Kriegsman	163	448	3.40	814
April 4	do	165	549	3.84	1,020
May 10	do	154	269	2.24	222
June 29	do	152	233	2.04	145

[a] Ice along edges. The flow was diminished by about 65 per cent of the open-channel rating.

Daily gage height, in feet, of St. Joseph River at Fort Wayne, Ind., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	3.0	3.55	3.05	8.05	2.45	2.2	2.0
2	2.9	3.25	3.0	6.9	2.4	2.1	2.0
3	2.75	2.85	3.5	5.2	2.35	2.05	2.05
4	3.3	2.7	4.9	4.85	2.35	2.0	2.0
5	3.6	2.7	4.75	3.4	2.5	2.0	1.95
6	3.25	3.1	4.35	3.45	2.55	2.0	1.95
7	3.3	2.9	4.05	3.55	2.4	1.95	1.8
8	3.25	2.8	3.75	3.15	2.3	1.95	1.8
9	3.05	2.7	3.4	4.5	2.25	3.05	1.8
10	2.9	2.6	3.3	5.05	2.25	4.55	1.75
11	2.85	2.4	3.35	4.55	2.2	4.45	2.4
12	2.65	2.35	3.25	4.05	2.15	4.15	2.3
13	2.55	2.15	3.05	3.75	2.15	4.0	2.1
14	2.35	2.2	2.9	3.9	2.1	3.95	1.9
15	2.3	2.5	2.85	5.95	2.1	3.7	1.9
16	2.55	2.55	2.75	5.7	2.1	3.25	2.3
17	2.75	2.55	2.75	5.0	2.35	3.0	2.3
18	2.75	2.1	2.45	4.55	2.65	2.8	2.3
19	2.95	2.05	2.45	4.1	2.55	2.55	2.2
20	2.75	2.0	2.3	3.65	2.3	2.45	2.2
21	4.1	2.05	2.6	3.3	2.25	2.75	.....
22	7.3	2.2	2.25	3.0	2.1	2.8	.....
23	8.0	2.2	2.45	2.9	2.05	2.6	.....
24	7.95	2.3	2.4	2.75	2.05	2.35	.....
25	7.1	2.85	2.4	2.65	2.0	2.25	.....
26	6.45	3.55	3.4	3.6	2.0	2.2	.....
27	6.1	3.7	7.7	3.0	2.35	2.1	.....
28	5.2	3.25	9.15	2.9	2.75	2.05	.....
29	4.55	.....	8.55	2.75	2.5	2.05	.....
30	4.0	.....	7.9	2.55	2.35	2.1	.....
31	3.7	.....	8.65	.....	2.3	.....	.....

NOTE.—Flow affected by ice conditions during part of February.

Rating table for St. Joseph River at Fort Wayne, Ind., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	80	3.10	635	4.40	1,515	6.20	3,190
1.90	105	3.20	695	4.50	1,590	6.40	3,420
2.00	135	3.30	755	4.60	1,670	6.60	3,660
2.10	165	3.40	815	4.70	1,750	6.80	3,900
2.20	200	3.50	880	4.80	1,830	7.00	4,150
2.30	240	3.60	945	4.90	1,910	7.20	4,410
2.40	280	3.70	1,010	5.00	2,000	7.40	4,670
2.50	325	3.80	1,080	5.20	2,180	7.60	4,940
2.60	370	3.90	1,150	5.40	2,365	7.80	5,220
2.70	420	4.00	1,220	6.60	2,560	8.00	5,500
2.80	470	4.10	1,290	5.80	2,760	9.00	7,000
2.90	525	4.20	1,365	6.00	2,970	10.00	8,600
3.00	580	4.30	1,440				

NOTE.—The above table is applicable only for open-channel condition. It is based on discharge measurements made during 1905–6, and is well defined between gage heights 2 feet and 6 feet.

Monthly discharge of St. Joseph River at Fort Wayne, Ind., for 1906.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
January	5,500	240	1,430
February [a]	1,010	.....	330
March	7,240	220	1,570
April	5,580	348	1,420
May	445	135	243
June	1,630	120	490
July (1–20)	280	68	156

[a] Discharge corrected for effect of ice conditions.

NOTE.—Values are rated as follows: February, fair; remainder of period, excellent.

ST. MARYS RIVER AT FORT WAYNE, IND.

This station was established March 20, 1905, and was discontinued July 21, 1906. It was located on the Taylor Street Bridge, in Fort Wayne, about 2.5 miles above the junction of the stream with the St. Joseph. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 55.

Discharge measurements of St. Marys River at Fort Wayne, Ind., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 20	Hanna and Clapp	120	600	5.59	1,360
May 26	M. S Brennan	104	199	2.17	208
July 13	S. K. Clapp	105	254	2.51	246
August 22	M. S. Brennan	104	173	1.87	122
October 4	do	105	182	1.92	133
December 7	do	113	516	5.00	451
1906.					
March 9	E. F. Kriegsman	104	226	2.60	306
April 4	do	138	745	6.42	1,870
April 5	do	120	609	5.60	1,610
May 11	do	65	56	1.40	58
May 11	do	85	117	1.40	55
June 29	do	46	22	1.07	31

Daily gage height, in feet, of St. Marys River at Fort Wayne, Ind., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	3.25	2.38	2.20	11.25	1.54	1.26	1.02
2	3.50	2.53	2.25	9.95	1.50	1.28	1.02
3	3.85	2.15	2.68	8.12	1.48	1.29	1.02
4	4.10	2.05	2.67	6.42	1.45	1.30	1.20
5	4.35	1.95	2.60	5.40	1.43	1.40	1.35
6	4.05	1.94	2.57	5.08	1.40	1.45	1.49
7	3.85	1.93	2.51	4.45	1.37	1.50	1.60
8	3.40	1.90	2.45	4.49	1.35	1.80	1.63
9	3.05	1.87	2.55	7.98	1.33	1.89	1.65
10	3.00	1.85	2.53	6.05	1.32	1.90	1.72
11	2.95	1.82	2.51	4.77	1.32	1.80	1.95
12	2.80	1.80	2.48	3.96	1.32	1.72	2.90
13	2.79	1.74	2.45	3.50	1.29	1.65	2.65
14	.....	1.70	2.43	6.38	1.25	1.56	2.39
15	.....	1.68	2.35	6.28	1.22	1.40	1.90
16	.....	1.65	2.15	4.95	1.20	1.35	1.50
17	2.85	1.63	2.15	4.06	1.18	1.40	1.35
18	.....	1.60	2.45	3.55	1.17	1.45	1.32
19	.....	1.57	2.30	3.11	1.16	1.45	1.29
20	.....	1.68	2.20	2.80	1.15	1.40	1.26
21	5.37	1.75	2.10	2.52	1.15	1.35	1.24
22	7.00	1.80	2.05	2.27	1.14	1.33	.....
23	6.15	1.89	2.00	2.14	1.13	1.30	.....
24	5.40	2.02	1.82	2.01	1.12	1.24	.....
25	4.33	2.86	1.85	1.90	1.12	1.18	.....
26	3.51	2.83	2.05	1.85	1.11	1.15	.....
27	3.10	2.90	10.42	1.83	1.10	1.12	.....
28	2.70	3.22	10.92	1.80	1.10	1.10	.....
29	2.51	.....	10.20	1.72	1.09	1.06	.....
30	2.42	.....	10.20	1.57	1.09	1.02	.....
31	2.33	.....	11.60	.....	1.22	.....	.....

NOTE.—The river was frozen January 14 to 20, the ice reaching a thickness of 4 inches. The river was clear of ice on January 21, and was probably not obstructed after that date, except on February 28 and March 18 to 20, on which dates there was backwater caused by an ice gorge below.

Rating table for St. Marys River at Fort Wayne, Ind., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	23	2.30	210	3.60	586	5.80	1,530
1.10	30	2.40	234	3.70	620	6.00	1,630
1.20	38	2.50	260	3.80	655	6.20	1,730
1.30	47	2.60	286	3.90	690	6.40	1,850
1.40	57	2.70	314	4.00	725	6.60	1,970
1.50	69	2.80	342	4.20	800	6.80	2,090
1.60	82	2.90	370	4.40	880	7.00	2,210
1.70	96	3.00	400	4.60	960	8.00	2,810
1.80	111	3.10	430	4.80	1,040	9.00	3,510
1.90	127	3.20	460	5.00	1,130	10.00	4,210
2.00	145	3.30	490	5.20	1,230	11.00	5,010
2.10	165	3.40	522	5.40	1,330	12.00	5,810
2.20	187	3.50	554	5.60	1,430		

NOTE.—The above table is applicable only for open-channel conditions. It is based on twelve discharge measurements made during 1905–6. It is well defined between gage heights 1.0 foot and 2.7 feet, and is fairly well defined above 2.7 feet.

Monthly discharge of St. Marys River at Fort Wayne, Ind., for 1905-6.

[Drainage area, 740 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
May 26-31 [a]	234	117	174	0.235	0.05
June	2,660	69	309	.418	.47
July	325	27	90.9	.123	.14
August	300	26	98.1	.133	.15
September	880	26	270	.365	.41
October	165	50	81.9	.111	.13
November	992	47	145	.196	.22
December [b]	760	90	386	.522	.60
1906.					
January [c]	2,210	.....	586	.792	.91
February [c]	370	78	157	.212	.22
March [c]	5,490	114	945	1.28	1.48
April	5,210	78	1,120	1.51	1.68
May	74	29	43.6	.059	.07
June	127	24	61.1	.083	.09
July 1-21	370	24	97.7	.132	.10

[a] Owing to errors in chain length, no reliable estimates of discharge can be made prior to May 26, 1905.
[b] Backwater caused by ice gorge below gage December 4 to 8 and 13 to 16, 1905; discharge estimated.
[c] During ice periods discharge estimated.
NOTE.—Values for 1905 and 1906 are good.

TIFFIN RIVER NEAR DEFIANCE, OHIO.

This station was established May 19, 1903, and was discontinued March 31, 1906. It was located at the highway bridge on the new road to Evansport, one-half mile above the settlement of Brunnesburg and 3 miles by river above the center of the city of Defiance. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 56, where are given also references to publications that contain data for previous years.

A measurement was made March 8, 1906, by E. F. Kriegsman, with the following results:

Width, 107 feet; area, 434 square feet; gage height, 4.69 feet; discharge, 507 second-feet.

Daily gage height, in feet, of Tiffin River near Defiance, Ohio, for 1906.

Day.	Feb.	Mar.	Day.	Feb.	Mar.	Day.	Feb.	Mar.
1	.....	4.4	12	.....	4.4	23	.....	3.3
2	.....	3.9	13	.....	4.2	24	.....	3.4
3	.....	4.65	14	.....	3.9	25	.....	[a] 3.4
4	.....	[a] 4.9	15	.....	3.8	26	4.4	3.4
5	.....	5.1	16	.....	3.7	27	4.5	8.2
6	.....	5.7	17	.....	3.6	28	4.7	10.6
7	.....	5.2	18	.....	[a] 3.4	29	.....	10.4
8	.....	4.8	19	.....	3.2	30	.....	9.7
9	.....	4.6	20	.....	3.1	31	.....	9.1
10	.....	4.75	21	.....	3.6			
11	.....	[a] 4.6	22	.....	3.4			

[a] Gage heights interpolated.

Rating table for Tiffin River near Defiance, Ohio, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.10	159	3.80	309	4.50	499	7.00	1,320
3.20	178	3.90	334	4.60	528	8.00	1,690
3.30	198	4.00	360	4.70	558	9.00	2,090
3.40	219	4.10	387	4.80	588	10.00	2,500
3.50	240	4.20	414	4.90	619	11.00	2,930
3.60	262	4.30	442	5.00	650		
3.70	285	4.40	470	6.00	970		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1906, and is well defined below gage height 5.7 feet.

Monthly discharge of Tiffin River near Defiance, Ohio, for 1906.

[Drainage area, 748 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
February (26–28)	558	470	509	0.680	0.08
March	2,760	159	714	.955	1.10

NOTE.—Values for 1906 are excellent.

BLACK RIVER BASIN.

BLACK RIVER NEAR ELYRIA, OHIO.

This station was established May 23, 1903, the object being to furnish data for the water supply of nearby towns, and was discontinued July 21, 1906. It was located at the North Ridge Road Bridge, about 5 miles from the center of the city of Elyria. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 59, where are given also references to publications that contain data for previous years.

Discharge measurements of Black River near Elyria, Ohio, in 1904–1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1904.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 9	R. W. Pratt	79	188	3.55	691
May 17	do	63	66	1.70	68
June 22	do	35	20	1.15	12
Do	do	35	19	1.15	11.4
July 6	do	80	246	4.11	894
July 28	do	41	24	1.28	25
August 11	do	34	14	1.05	8.2
October 4	do	35	17	1.14	10.5
November 4	do	33	13	0.96	2.8
1905.					
January 17 [a]	R. W. Pratt	75	119	2.80	114
February 1 [a]	do	39	41	1.75	24
May 24	M. S. Brennan	69	52	1.44	56
October 20	R. W. Pratt	55	.....	1.08	10.3
November 4	do	55	30	1.15	12
1906.					
March 7	E. F. Kriegsman	68	66	1.62	103
May 14	do	66	42	1.33	48

[a] River frozen over; measurements indicate that flow is about 25 per cent of the open-channel discharge for the same gage heights.

Daily gage height, in feet, of Black River near Elyria, Ohio, for 1905–6.

1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.4	1.1	6.0	1.7	1.8	1.45	1.1	0.9	1.1	1.0	1.2	4.3
2	2.35	1.1	4.0	1.5	1.8	1.4	1.0	.9	1.1	1.1	1.2	4.0
3	2.3	1.2	4.0	1.4	1.6	1.4	1.0	.9	1.0	1.1	1.1	3.7
4	2.15	1.2	4.0	1.4	1.5	1.35	1.1	1.0	1.0	1.0	1.1	3.4
5	2.1	1.1	4.0	1.3	1.5	1.2	1.4	1.4	1.0	1.0	1.1	3.1
6	2.4	1.1	4.0	1.3	1.4	2.5	1.4	1.5	1.05	1.1	1.1	2.8
7	2.4	1.0	4.1	1.2	1.5	2.5	1.3	1.4	1.05	1.1	1.9	2.4
8	2.2	1.0	5.0	1.2	1.4	3.5	1.35	.9	1.0	1.1	2.2	2.4
9	2.1	1.1	6.0	1.2	1.3	3.5	1.3	.9	1.0	1.05	2.1	2.3
10	1.7	1.1	5.0	1.4	1.4	3.0	1.4	1.1	1.05	.9	2.0	2.2
11	2.1	1.05	5.1	1.5	1.9	2.0	1.35	1.1	1.1	1.1	1.8	2.2
12	2.2	1.05	5.0	5.0	11.1	3.0	1.3	1.1	1.2	1.1	1.6	2.1
13	2.0	.9	5.0	4.0	8.0	2.1	1.2	1.0	1.4	1.2	1.5	2.1
14	1.9	.9	4.1	3.5	4.1	2.05	1.2	1.5	1.4	1.2	1.5	2.1
15	1.7	.9	4.0	2.2	3.0	1.1	1.1	2.5	1.3	1.1	1.4	2.0
16	2.1	.9	2.1	2.5	3.5	2.0	1.1	2.5	1.2	1.1	1.4	1.9
17	2.8	.9	2.1	2.5	3.5	3.5	1.1	2.5	1.1	1.2	1.3	1.7
18	3.3	1.0	3.0	3.0	3.5	3.0	1.0	2.0	2.5	1.2	1.3	1.6
19	2.1	1.0	5.1	2.1	3.0	2.5	1.0	2.0	2.0	1.3	1.2	1.5
20	2.0	1.05	6.0	2.1	2.1	2.0	1.05	2.0	1.8	1.2	1.2	1.3
21	1.7	1.3	5.0	6.1	2.0	2.0	1.0	2.0	2.0	1.5	1.2	1.3
22	1.6	1.35	4.1	6.0	2.0	1.7	1.15	1.8	1.8	1.9	1.1	3.3
23	1.5	3.0	3.0	4.1	1.9	1.5	1.1	2.5	1.7	1.8	1.1	3.0
24	1.5	3.0	3.0	3.0	1.5	1.4	1.1	2.0	1.5	1.7	1.0	2.6
25	1.6	4.0	2.5	2.1	1.4	1.3	1.05	2.0	1.5	1.5	1.0	2.4
26	1.55	4.0	2.5	2.0	1.6	1.2	1.0	1.8	1.4	1.5	1.0	2.0
27	1.5	6.0	2.5	3.1	3.0	1.1	1.0	1.5	1.3	1.4	1.1	1.6
28	1.4	7.0	2.5	2.1	2.8	1.1	1.1	1.4	1.2	1.2	1.4	1.5
29	1.2	.....	2.0	2.0	2.7	1.05	1.1	1.4	1.1	1.1	1.9	1.8
30	1.2	.....	1.8	1.8	2.6	1.0	1.0	1.3	1.0	1.1	4.5	2.1
31	1.1	.....	1.7	.....	2.5	.....	1.0	1.2	.....	1.2	.....	2.0

1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.1	1.6	2.5	7.5	1.3	2.0	0.9	.....	.....	.....	.....	.....
2	2.2	1.5	2.1	7.1	1.25	1.7	.9	.....	.....	.....	.....	.....
3	2.3	1.4	1.8	5.2	1.2	1.4	.95	.....	.....	.....	.....	.....
4	2.3	1.6	1.7	4.0	1.2	1.35	1.1	.....	.....	.....	.....	.....
5	2.2	1.6	1.7	3.9	1.3	1.3	1.15	.....	.....	.....	.....	.....
6	2.1	1.5	1.6	3.5	1.25	1.2	1.1	.....	.....	.....	.....	.....
7	2.0	1.4	1.6	3.1	1.2	1.3	1.05	.....	.....	.....	.....	.....
8	2.0	1.4	1.7	3.0	1.2	1.1	1.0	.....	.....	.....	.....	.....
9	2.2	1.4	1.8	2.8	1.4	1.1	1.0	.....	.....	.....	.....	.....
10	2.2	1.5	1.8	2.9	1.5	1.15	.95	.....	.....	.....	.....	.....
11	1.9	1.8	1.9	2.8	1.45	1.1	.95	.....	.....	.....	.....	.....
12	1.8	1.9	2.1	2.7	1.3	1.05	.9	.....	.....	.....	.....	.....
13	1.9	1.9	2.2	2.5	1.25	1.0	.9	.....	.....	.....	.....	.....
14	2.5	2.0	2.2	2.1	1.4	1.0	1.2	.....	.....	.....	.....	.....
15	3.8	2.5	2.3	1.8	1.3	1.0	1.8	.....	.....	.....	.....	.....
16	3.9	2.9	2.2	1.9	1.3	.95	1.9	.....	.....	.....	.....	.....
17	4.1	3.4	1.9	2.1	1.3	.95	1.6	.....	.....	.....	.....	.....
18	3.4	3.5	1.7	1.8	1.25	.9	1.4	.....	.....	.....	.....	.....
19	3.2	3.4	2.1	1.7	1.2	1.0	1.2	.....	.....	.....	.....	.....
20	3.1	3.5	2.2	1.5	1.2	1.0	1.2	.....	.....	.....	.....	.....
21	3.0	4.1	2.3	1.4	1.3	.95	1.1	.....	.....	.....	.....	.....
22	2.8	4.3	2.0	1.3	1.25	1.05	.....	.....	.....	.....	.....	.....
23	2.5	3.9	1.8	1.3	1.2	1.0	.....	.....	.....	.....	.....	.....
24	2.4	3.5	1.7	1.2	1.2	1.0	.....	.....	.....	.....	.....	.....
25	2.4	3.3	1.7	1.3	1.15	.9	.....	.....	.....	.....	.....	.....
26	2.3	3.2	1.8	1.4	1.15	.9	.....	.....	.....	.....	.....	.....
27	2.1	3.1	12.2	1.4	1.25	.95	.....	.....	.....	.....	.....	.....
28	2.0	2.8	12.4	1.3	1.2	.95	.....	.....	.....	.....	.....	.....
29	1.9	.....	7.7	1.2	1.2	.9	.....	.....	.....	.....	.....	.....
30	1.7	.....	7.9	1.2	2.15	.9	.....	.....	.....	.....	.....	.....
31	1.6	.....	8.2	.....	2.05	.....	.....	.....	.....	.....	.....	.....

NOTE.—The above gage heights for 1905–6 were recorded erroneously in some cases, but have been corrected as far as possible. They are still liable to some error. Ice conditions January 1 to February 28 1905. River frozen February 1 to 18, 1906; thickness of ice, 0.2 to 0.8 foot.

Rating table for Black River near Elyria, Ohio, for 1904-1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	2	2.30	294	3.70	748	6.00	1,550
1.00	5	2.40	324	3.80	782	7.00	1,900
1.10	10	2.50	355	3.90	816	8.00	2,250
1.20	18	2.60	386	4.00	850	9.00	2,600
1.30	31	2.70	417	4.20	920	10.00	2,950
1.40	48	2.80	448	4.40	990	11.00	3,300
1.50	70	2.90	479	4.60	1,060	12.00	3,650
1.60	94	3.00	510	4.80	1,130	13.00	4,000
1.70	120	3.10	544	5.00	1,200	14.00	4,350
1.80	148	3.20	578	5.20	1,270	15.00	4,700
1.90	177	3.30	612	5.40	1,340	16.00	5,050
2.00	206	3.40	646	5.60	1,410	17.00	5,400
2.10	235	3.50	680	5.80	1,480	18.00	5,750
2.20	264	3.60	714				

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-1906, and is not well defined.

Monthly discharge of Black River near Elyria, Ohio, for 1904-1906.

[Drainage area, 417 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1904.					
January	5,920	31	808	1.94	2.24
February	3,720	235	869	2.09	2.25
March	4,210	70	1,210	2.90	3.34
April	4,140	18	676	1.62	1.81
May	1,480	5	227	.544	.63
June	2,500	5	300	.719	.80
July	2,500	5	255	.612	.71
August	177	2	68.8	.165	.19
September	31	2	11.0	.026	.03
October	31	2	[a] 12.1	.029	.03
November	177	2	75.1	.180	.20
December (1-18)	94	5	48.0	.115	.08
1905.					
March	1,550	120	799	1.92	2.21
April	1,580	18	371	.890	.99
May	3,340	31	440	1.06	1.22
June	680	5	215	.516	.58
July	48	5	16.5	.040	.05
August	355	2	112	.269	.31
September	355	5	56.2	.135	.15
October	177	2	32.1	.077	.09
November	1,020	5	94.7	.227	.25
December	955	31	319	.765	.88
1906.					
January	885	94	346	.830	.96
February 19-28	955	448	684	1.64	.61
March	3,790	94	616	1.48	1.71
April	2,080	18	410	.983	1.10
May	250	14	40.8	.098	.11
June	206	2	20.6	.049	.05
July 1-21	177	2	28.7	.069	.05

[a] Gage heights published as 1.01, 1.02, and 1.03 in Water-Supply Paper No. 129 should be 1.1, 1.2, and 1.3.

NOTE.—The above values are rated as fair with the exception of January to March, 1904. No data concerning ice conditions during these months were available and hence the open-channel rating was applied for this period. The procedure may involve large errors.

CUYAHOGA RIVER BASIN.

DESCRIPTION OF BASIN.

Cuyahoga River rises in eastern Geauga County, flows south-southwestward to a point within about 2 miles of Akron, then turns sharply and flows northwestward to Lake Erie. Its course is extremely tortuous. In one place a straight line 5 miles long would connect two points 12 miles apart by the channel. The valley consists largely of a series of basins, the hills reaching 200 feet or more in height. Many lakes and swamps occur in the headwater region.

CUYAHOGA RIVER AT INDEPENDENCE, OHIO.

This station was established September 21, 1903, and was discontinued July 21, 1906. It was located at the highway bridge at the town of Independence, 10 miles south of Cleveland and 4 miles south of the gaging station formerly located on the highway bridge between Brooklyn and Newberg, Ohio. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 60, where are given also references to publications that contain data for previous years.

Discharge measurements of Cuyahoga River at Independence, Ohio, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 7	E. F. Kriegsman	78	335	6.26	803
May 14	do	62	264	5.39	419

Daily gage height, in feet, of Cuyahoga River at Independence, Ohio, for 1906.

Day.	Jan.	Feb.[a]	Mar.	Apr.	May.	June.	July.
1	5.75	5.25	5.4	9.1	5.1	4.8	4.5
2	5.4	4.75	5.25	8.8	5.05	5.5	4.5
3	5.35	4.9	5.45	7.75	5.0	5.0	4.55
4	7.2	5.0	5.9	6.65	5.05	4.9	5.0
5	6.85	5.25	6.4	6.4	5.65	4.8	4.85
6	6.55	5.25	6.2	7.0	5.9	4.95	5.0
7	6.4	5.5	6.25	6.7	6.4	5.05	5.2
8	6.25	5.5	6.2	6.0	6.05	5.1	5.1
9	5.75	5.5	6.05	6.35	5.8	5.0	4.85
10	5.45	5.5	6.3	7.5	6.0	4.95	5.0
11	5.6	5.48	6.5	7.1	6.75	4.65	4.8
12	5.4	5.45	6.4	7.0	5.6	4.8	4.7
13	5.4	5.45	5.5	7.0	5.6	4.65	4.7
14	5.35	5.4	5.4	6.85	5.55	4.6	4.5
15	5.3	5.4	5.3	6.6	5.3	4.7	4.5
16	6.25	5.4	5.25	6.35	5.2	4.6	4.5
17	5.95	5.4	5.2	6.15	5.2	4.55	5.05
18	6.0	5.4	5.2	5.8	5.2	4.45	4.85
19	6.95	5.4	5.2	5.65	5.05	5.0	4.75
20	6.7	5.4	5.2	5.4	5.0	5.0	4.7

[a] Ice conditions during month.

Daily gage height, in feet, of Cuyahoga River at Independence, Ohio, for 1906—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
21	7.0	5.4	5.1	5.3	4.8	4.9	4.75
22	7.55	8.0	5.1	5.15	4.9	4.85	.....
23	8.25	7.35	5.1	5.5	4.95	4.75	.....
24	7.6	6.75	5.5	5.5	4.9	4.6	.....
25	6.9	6.6	5.45	5.4	4.85	4.4	.....
26	6.3	6.3	5.3	5.5	4.9	4.8	.....
27	5.85	5.9	15.9	5.5	4.8	4.75	.....
28	5.6	5.65	14.4	5.4	4.5	4.55	.....
29	5.45	.....	11.5	5.2	4.85	4.55	.....
30	5.3	.....	11.9	5.15	4.8	4.6	.....
31	5.25	.....	12.15	.....	4.55	.....	.....

NOTE.—The rating table published for 1905 will give approximate results if applied to the above gage heights.

LAKE ONTARIO DRAINAGE.

GENERAL FEATURES.

In the northwestern part of the State of New York, between Niagara and St. Lawrence rivers, is an area aggregating 12,400 square miles drained by streams which flow into Lake Ontario. The divide which controls this drainage is very irregular. Extending to the south and southeast from Fort Niagara, it passes around the headwaters of the Genesee a short distance into Pennsylvania; thence reentering New York it runs southward and eastward from the interior group of lakes, turns to the north, encircles the sources of Black River, turns again to the west, and descends to the lake. The country thus included is level or gently undulating in the counties bordering the lake, but farther south it becomes more rolling, and a series of ridges, gradually increasing in height, stretch down between Cayuga and Seneca and their companion lakes, finally becoming merged with the elevated, broken country forming the principal divide, the abrupt slopes of which attain altitudes of from 2,000 to 2,500 feet about the headwaters of the Genesee.

The easterly or Black River lobe of the drainage basin receives the run-off from the southwestern slope of the Adirondack Mountains—largely a rugged and forest-covered area receiving heavy precipitation. especially in the winter.

The principal streams of the area are the Oswego, formed by the union of Seneca and Oneida rivers, which drain the chain of lakes in central New York, and Genesee, Salmon, and Black rivers.

GENESEE RIVER BASIN.

DESCRIPTION OF BASIN.

Genesee River rises in Potter County, Pa., 8 or 10 miles south of the New York-Pennsylvania boundary, flows northwestward for about 32 miles by general course, then turns to the northeast, and empties into

Lake Ontario 7 miles north of Rochester. The entire length of the stream, following bends, is about 135 miles, and the drainage area is 2,496 square miles.

In the 39 miles between Belmont, in central Allegany County, and Portage, in southwestern Livingston County, the fall of the water surface is 253 feet, an average of 6.4 feet per mile. At Portage the river plunges down in three magnificent falls, and thence nearly to Mount Morris flows at the bottom of a deep gorge. From Mount Morris to Rochester the valley is broad and open and the stream is bordered by meadows subject to occasional overflow. At Rochester there is another abrupt descent over three heavy falls, amounting to about 260 feet within the city.

The series of remarkable lakes tributary to the Oswego basin is continued westward into the basin of the Genesee and includes Conesus, Hemlock, Canadice, and Honeoye lakes. These lakes serve as natural reservoirs and have inlets draining considerable areas at their upper ends. The slopes adjacent to the lakes themselves are narrow and steep and are drained by gulleys and torrential brooks. The area below the lakes is rolling and the soil is rich and extensively cultivated. The areas and elevations of these lakes are shown in the following table:

Areas and elevations of lakes in Genesee River basin.[a]

Lake.	Elevation.	Water-surface area.	Drainage area.	Per cent water surface.
	Feet.	*Sq. miles.*	*Sq. miles.*	
Hemlock Lake	896	2.8	46.8	6.12
Canadice Lake	1,092	.7	12.6	5.57
Honeoye Lake	800	2.5	39.6	6.41

[a] These lake basins are shown on the Honeoye, Canandaigua, Naples, and Wayland topographic atlas sheets of the United States Geological Survey, from which the areas have been taken, with the exception of those for Hemlock and Canadice lakes, which are from surveys for the Rochester waterworks.

Above all the private dams at Rochester the State has a dam for diverting water to the Erie Canal, and in the basin of Black Creek, one of the upper tributaries of the Genesee from the west, are two reservoirs, owned by the State, also used for the benefit of the Erie Canal.

Cuba reservoir, on the Genesee-Allegheny divide, receives the drainage from a tributary area of 26.6 square miles. The storage volume is 454,000,000 cubic feet. The overflow from this reservoir enters Allegheny River. The storage water may be turned into the summit level of the abandoned Genesee Valley Canal and thence into Genesee River.

GENESEE RIVER AND CANASERAGA CREEK NEAR MOUNT MORRIS, N. Y.

This station was established May 22, 1903, and was discontinued April 30, 1906. It was located at the highway bridge near Mount Morris, a short distance below the inflow of Canaseraga Creek. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 65, where are given also references to publications that contain data for previous years.

Discharge measurements of Genesee River near Mount Morris, N. Y., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 12 [a]	C. C. Covert	118	298	5.75	452
February 13 [a]	do	118	290	5.78	479
February 16 [a]	do	127	373	6.00	525
March 29	do	171	1,640	13.90	5,430
March 30	do	166	1,500	13.10	5,780
March 31	do	193	2,660	19.05	10,800
March 31	do	193	2,630	18.85	10,200
April 1	do	165	1,750	14.33	5,920
April 2	do	163	1,210	11.60	4,360
April 3	do	161	1,050	10.50	3,930
April 4	do	161	1,120	10.85	4,460
April 14	do	153	864	9.38	3,080
April 21	do	120	502	6.89	1,660
April 22	do	127	460	6.60	1,520
April 23	do	127	504	6.90	1,740
September 15	do	70	191	4.15	238

[a] Measurements made under ice cover, average thickness of ice, 0.49 foot, 0.41 foot, and 0.68 foot, respectively. Gage heights to bottom of ice, 5.36 feet, 5.47 feet, and 5.42 feet, respectively.

Daily gage height, in feet, of Genesee River near Mount Morris, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.
1	8.2	6.4	6.65	13.85	17	8.95	5.75	4.95	9.45
2	7.3	5.8	6.85	11.2	18	7.95	5.8	4.8	8.4
3	6.8	7.7	6.3	10.3	19	7.2	5.6	4.8	7.65
4	7.2	7.5	8.25	10.5	20	6.55	5.5	5.9	7.2
5	9.7	7.35	8.0	13.4	21	12.05	5.6	5.15	6.8
6	7.7	7.1	6.1	12.35	22	16.25	6.5	5.0	6.6
7	6.3	6.65	5.9	11.45	23	15.45	6.55	5.0	6.8
8	6.1	6.5	5.7	9.95	24	15.3	6.1	4.7	6.5
9	7.2	6.4	5.5	9.55	25	10.5	5.85	4.85	6.25
10	9.0	6.3	5.5	13.2	26	8.35	6.05	5.05	5.95
11	8.8	6.05	5.25	14.1	27	7.45	5.65	9.1	5.75
12	8.9	5.75	5.25	11.7	28	7.0	7.05	21.43	5.5
13	8.3	5.55	5.25	10.35	29	6.7	.....	14.7	5.5
14	7.7	5.95	5.05	9.35	30	6.3	.....	13.5	5.65
15	7.55	6.0	5.0	10.55	31	6.15	.....	18.45	.....
16	7.05	5.8	5.1	11.1					

NOTE.—River frozen over from February 1 to March 20, approximately. During frozen period gage readings were taken to water surface through a hole cut in ice. Ice averaged from 0.2 to 0.6 foot thick at gage and from 0.3 to 0.8 foot thick 200 feet below.

This station has backwater conditions during the spring floods; also considerable water flows around the left-hand end of the bridge above gage height 18.0 feet.

Rating table for Genesee River near Mount Morris, N. Y., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.70	490	6.10	1,215	7.50	2,030	9.80	3,560
4.80	535	6.20	1,270	7.60	2,090	10.00	3,700
4.90	580	6.30	1,325	7.70	2,155	10.20	3,840
5.00	625	6.40	1,380	7.80	2,220	10.40	3,980
5.10	675	6.50	1,435	7.90	2,285	10.60	4,120
5.20	725	6.60	1,490	8.00	2,350	10.80	4,270
5.30	775	6.70	1,550	8.20	2,480	11.00	4,420
5.40	830	6.80	1,610	8.40	2,610	12.00	5,170
5.50	885	6.90	1,670	8.60	2,740	13.00	5,960
5.60	940	7.00	1,730	8.80	2,870	14.00	6,760
5.70	995	7.10	1,790	9.00	3,000	15.00	7,560
5.80	1,050	7.20	1,850	9.20	3,140	16.00	8,360
5.90	1,105	7.30	1,910	9.40	3,280	17.00	9,160
6.00	1,160	7.40	1,970	9.60	3,420	18.00	9,960

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1906 and is fairly well defined.

Monthly discharge of Genesee River near Mount Morris, N. Y., for 1906.

[Drainage area, 1,070 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	8,560	1,220	2,830	2.64	3.04
February	1,080	442	650	.607	.63
March	11,000	268	1,690	1.58	1.82
April	6,840	885	3,290	3.07	3.42

NOTE.—Discharges February 1 to March 20 have been taken as 50 per cent of the open-water flow: backwater assumed March 28, discharge corrected.

Values are rated as follows: January and April, good; March, fair; February, approximate.

Discharge measurements of Canaseraga Creek near Mount Morris, N. Y., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 29	C. C. Covert	84	500	9.22	1,880
March 30	do	84	456	8.90	1,620
March 31 [a]	do	94	900	13.55	1,670
April 2	do	81	368	7.85	1,430
April 3	do	75	310	7.00	1,150
April 21	do	66	142	4.45	478

[a] Backwater from Genesee River.

GENESEE RIVER AT HIGH DAM NEAR MOUNT MORRIS, N. Y.

A gaging station has been established at the dam of the Mount Morris Water Power Company, in the village of Mount Morris, N. Y., and readings have been taken regularly twice each day, by John McAstocker, since September 1, 1905.

The dam is of masonry construction, having a horizontal crest of open cross section 255 feet long. There are two waste ways, having crests each 12 inches wide and 18.0 feet and 17.9 feet long, respectively, closed by stop planks to about 2 feet above the main crest; also one short spillway with crest 6 inches wide and 17 feet long and about 1 foot higher than the wasteways. The dam and the spillways

are separated by masonry piers 6 feet, 8 feet, and 6 feet in width, respectively.

A portion of the flow is diverted through a section of the old Genesee Valley Canal, which is utilized as a headrace, the power being used to drive a number of mills and factories. In order to determine the amount of this diversion, a gage has been placed in the tailrace below the mills. It is read twice each day by F. M. Goff, electrical engineer in the employ of the power company. A number of meter measurements have been made, and a rating curve to determine the daily flow through the canal is partly developed. When the complete curve is developed, the data will be published.

GENESEE RIVER AT ROCHESTER, N. Y.

This station was established February 9, 1904. It is located at the Elmwood Avenue Bridge, in Rochester, N. Y. The conditions at this station[a] and the bench marks are described in Water-Supply Paper No. 170, page 69, where are given also references to publications that contain data for previous years.

Discharge measurements of Genesee River at Rochester, N. Y., in 1904–1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1904.					
July 20	C. C. Covert		1,010	1.30	592
August 9	E. H. Fisher		976	1.18	614
August 10	do		957	1.10	589
August 11	do		944	1.15	584
August 12	do		963	1.20	667
August 15	do		973	1.10	567
August 27	do		972	1.22	705
August 30	do		916	1.07	554
September 17	do		923	1.05	517
November 11	C. C. Covert		994	1.20	554
1905.					
March 22	Covert and Weeks	382	4,220	10.00	24,700
March 22	do	382	4,200	9.95	24,000
March 25	do	382	4,300	10.20	25,500
March 27	do	382	4,200	9.92	25,200
March 27	do	382	4,160	9.82	24,500
March 28	do	382	4,050	9.50	23,000
March 29	do	382	3,960	9.08	22,500
April 2	do	373	2,140	4.18	6,500
April 3	do	372	1,890	3.50	5,200
April 4	do	372	1,820	3.28	4,500
May 28	C. C. Covert	352	974	1.11	442
1906.					
February 14[b]	Covert and Weeks	306	1,710	1.40	728
February 15[c]	do	360	1,020	1.53	884
March 28	Weeks and Casey	383	3,160	6.85	14,100
March 29	do	383	3,320	7.32	15,100
March 30	do	383	2,680	5.64	9,500
March 31	do	383	2,860	6.06	12,400
March 31	do	383	2,940	6.31	13,300
April 1	do	384	3,040	6.60	14,200
April 1	do	383	3,050	6.36	13,000
April 2	do	376	2,480	5.08	8,500
April 2	do	375	2,330	4.70	7,100
April 3	do	374	2,100	4.10	5,800

[a] The gage datum is 245.59 feet above the city topographic datum, to which gage heights published for 1904 refer.

[b] Measured under ice cover, about one-fourth mile above regular section; gage height to top of ice, 1.50 feet; average thickness of ice, 0.50 foot.

[c] Measured under ice cover at regular section; gage height to top of ice, 1.63 feet; average thickness of ice, 0.46 foot; some needle ice.

Daily gage height, in feet, of Genesee River at Rochester, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.0	2.0	1.7	6.5	1.8	2.4	1.5	1.1	1.3	1.2	3.0	2.06
2	2.9	2.0	2.0	5.6	1.9	2.0	1.4	1.2	1.2	1.3	3.0	2.05
3	2.9	2.0	1.5	4.2	2.2	1.9	1.4	1.3	1.1	1.6	3.0	2.04
4	2.5	2.0	1.9	3.8	3.5	1.8	2.2	1.2	1.1	1.4	2.9	2.03
5	2.3	2.0	2.7	4.0	3.0	1.7	2.6	1.6	1.1	1.4	2.8	2.02
6	3.3	1.9	3.1	4.9	3.1	1.5	2.0	1.7	1.1	1.5	2.6	2.01
7	2.9	1.9	2.1	4.6	2.9	2.7	1.8	1.6	1.0	2.5	2.4	6.02
8	2.4	1.8	2.0	4.0	2.5	2.5	1.6	1.6	1.0	3.5	2.3	6.08
9	2.4	1.8	1.9	3.6	2.2	2.7	1.4	1.7	1.0	2.8	2.1	5.0
10	2.3	1.8	1.8	5.0	2.1	1.9	1.4	1.7	1.0	2.4	2.0	3.06
11	2.1	1.7	1.6	5.9	2.4	1.8	1.4	1.5	1.0	2.5	2.0	3.01
12	1.9	1.7	1.3	5.5	2.3	1.8	1.3	1.6	1.0	2.8	2.3	4.04
13	2.2	1.4	1.6	4.5	2.1	1.8	1.3	1.8	1.0	2.6	2.06	3.03
14	1.9	1.4	1.5	3.8	2.0	1.7	1.2	1.6	1.0	2.2	3.01	3.0
15	1.7	1.5	1.6	3.5	2.2	1.5	1.1	1.5	1.0	2.1	2.09	3.02
16	1.9	2.0	1.5	4.0	2.2	1.5	1.1	1.5	1.0	2.0	2.08	6.0
17	2.2	2.0	1.4	3.8	2.1	1.5	1.1	1.4	1.0	1.9	2.06	5.06
18	2.3	1.8	1.4	3.3	2.1	1.8	1.2	1.3	1.0	1.8	2.08	4.0
19	2.2	1.6	1.4	3.0	2.5	1.9	1.4	1.2	1.0	1.7	4.07	3.05
20	2.1	1.4	1.3	2.8	2.3	1.9	1.3	1.1	1.0	1.9	5.0	3.0
21	2.7	1.5	1.5	2.5	2.0	1.7	1.2	1.1	1.0	3.4	4.04	2.06
22	4.9	1.8	1.6	2.3	1.8	1.6	1.2	1.4	1.0	3.1	6.04	2.01
23	5.6	2.0	1.4	2.2	1.7	1.5	1.2	1.4	1.3	2.6	5.08	2.1
24	5.3	2.0	1.6	2.3	1.6	1.5	1.2	1.8	1.3	2.5	4.06	2.0
25	4.9	2.1	1.6	2.2	1.9	1.5	1.1	2.0	1.4	2.3	3.07	3.0
26	3.5	2.1	1.5	2.1	2.2	1.5	1.0	1.8	1.3	3.6	3.04	3.2
27	2.7	1.8	2.4	2.0	1.9	1.5	1.0	1.5	1.3	3.3	3.02	3.0
28	2.4	1.6	6.0	1.9	1.9	1.4	1.0	1.4	1.1	2.6	3.00	2.8
29	2.1	.....	7.3	1.8	3.2	1.3	1.1	1.4	1.1	2.4	3.01	2.7
30	2.4	.....	5.8	1.8	2.6	1.5	1.2	1.5	1.1	2.5	2.08	2.3
31	2.1	.....	6.0	.....	2.2	.....	1.2	1.3	.....	2.5	.....	2.3

Rating table for Genesee River at Rochester, N. Y., for 1904–1906.

Gage height.	Discharge	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	400	2.30	2,140	3.60	4,840	5.80	10,800
1.10	490	2.40	2,320	3.70	5,080	6.00	11,400
1.20	580	2.50	2,500	3.80	5,320	6.20	12,000
1.30	670	2.60	2,700	3.90	5,560	6.40	12,600
1.40	760	2.70	2,900	4.00	5,800	6.60	13,220
1.50	850	2.80	3,100	4.20	6,320	6.80	13,840
1.60	1,000	2.90	3,300	4.40	6,840	7.00	14,500
1.70	1,150	3.00	3,500	4.60	7,380	8.00	17,800
1.80	1,300	3.10	3,720	4.80	7,940	9.00	21,400
1.90	1,450	3.20	3,940	5.00	8,500	10.00	25,100
2.00	1,600	3.30	4,160	5.20	9,060	11.00	29,000
2.10	1,[illegible]	3.40	4,380	5.40	9,620		
2.20	1,900	3.50	4,600	5.60	10,200		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906 and is well defined.

Monthly discharge of Genesee River at Rochester, N. Y., for 1904–1906.

[Drainage area, 2,360 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1904. [a]					
February (9–12)	31,800	14,500	24,000	10.17	1.51
March 2–31 [b]	27,000	2,500	12,900	5.47	6.10
April [b]	13,200	4,160	7,460	3.16	3.53
May	7,660	1,450	3,160	1.34	1.54
June	8,500	670	2,230	.945	1.05
July	3,100	670	1,310	.555	.64
August	1,150	400	634	.269	.31
September	850	400	523	.222	.25
October	2,500	490	986	.418	.48
November	760	490	562	.238	.27
December	13,200	490	1,570	.665	.77
1905. [c]					
January (1–27)	5,560	1,600	2,800	1.19	1.20
March (18–31)	25,900	1,960	20,200	8.56	4.46
April	13,200	2,320	4,150	1.76	1.96
May	2,140	1,300	1,460	.619	.71
June	7,660	850	2,670	1.13	1.26
July	4,380	715	1,340	.568	.65
August	3,720	535	1,230	.521	.60
September	850	400	580	.246	.27
October	1,000	400	589	.250	.29
November	7,940	580	1,400	.593	.66
December	7,380	580	2,690	1.14	1.31
1906. [d]					
January	10,200	1,150	3,250	1.38	1.59
February	1,780	760	1,320	.559	.58
March	15,500	670	2,680	1.14	1.31
April	12,900	1,300	5,110	2.17	2.42
May	4,600	1,000	2,130	.902	1.04
June	2,900	670	1,300	.551	.61
July	2,700	400	783	.332	.38
August	1,600	490	878	.371	.43
September	760	400	484	.205	.23
October	4,840	580	2,280	.966	1.11
November	11,600	1,600	3,650	1.55	1.72
December	11,600	1,600	4,070	1.72	1.98
The year	15,500	400	2,330	.987	13.4

[a] Values for 1904 are rated as follows: February to May, good; June, July, October, and December, fair; August, September, and November, approximate.
[b] Discharge interpolated for missing days.
[c] Values for 1905 are rated as follows: January, May to August, November, and December, fair; March and April, good; September and October, approximate.
[d] Values for 1906 are rated as follows: January, April, November, and December, good; February, March, May to August, and October, fair; September, approximate.

CANADICE LAKE OUTLET NEAR HEMLOCK, N. Y.

This station is located at a weir constructed at the outlet at the foot of the lake by the city engineer's department of Rochester, N. Y., in February, 1903. The entire yield of the drainage basin passes this weir. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 71, where are given also references to publications that contain data for previous years.

Monthly discharge of Canadice Lake outlet near Hemlock, N. Y., for 1906.

[Drainage area, 12.6 square miles.]

Month.	Mean discharge in second-feet.	Run-off.	
		Sec.-ft. per sq. mile.	Depth in inches.
January	9.52	0.755	0.87
February	9.33	.740	.77
March	11.1	.880	1.01
April	27.7	2.20	2.45
May	13.1	1.04	1.20
June	10.9	.864	.95
July	8.74	.693	.79
August	8.14	.646	.75
September	6.54	.519	.58
October	6.97	.552	.63
November	27.1	2.15	2.40
December	33.0	2.62	3.02
The year	14.3	1.13	15.02

HONEOYE CREEK AT EAST RUSH, N. Y.

This station was established February 13, 1903, and was discontinued April 30, 1906. It was located at the gristmill dam in the village of East Rush. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 72, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Honeoye Creek at East Rush, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.
1	84	84	60	527	17	60	70	60	305
2	60	42	60	445	18	60	77	77	301
3	52	42	148	329	19	84	70	44	305
4	123	43	194	282	20	104	70	53	229
5	141	42	172	553	21	169	172	74	231
6	111	37	123	542	22	246	196	94	219
7	77	33	84	505	23	321	104	70	214
8	44	42	99	444	24	132	148	60	179
9	44	40	70	541	25	84	169	25	149
10	31	43	70	1,176	26	70	172	70	149
11	29	25	77	764	27	70	84	1,107	125
12	61	38	52	574	28	77	60	1,073	131
13	88	39	52	497	29	60	.....	512	121
14	43	70	52	411	30	70	.....	510	131
15	54	70	52	366	31	84	.....	1,023	.....
16	60	70	52	345					

NOTE.—From January 1 to March 26 the discharge is approximate; the flow over crest of dam was obstructed by ice.

Monthly discharge of Honeoye Creek at East Rush, N. Y., for 1906.

[Drainage area, 238 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	321	29	90.0	0.378	0.44
February	196	25	76.8	.323	.34
March	1,110	25	202	.848	.98
April	1,180	121	370	1.55	1.73

NOTE.—Above values are rated as approximate.

OSWEGO RIVER BASIN.

DESCRIPTION OF BASIN.

Oswego River is formed by the union of Seneca and Oneida rivers about 12 miles northwest of Syracuse, N. Y., whence its course is northwestward to Oswego, where it enters Lake Ontario. The length of the river from the junction to the mouth is about 20.5 miles, and the drainage basin along this distance is a narrow strip of country, moderately rolling. Above the junction of Seneca and Oneida rivers the basin spreads out, attaining an extreme width east and west of about 100 miles and north and south of from 70 to 80 miles.

The most remarkable feature of the drainage basin is the chain of lakes stretching across its southern border. From west to east the principal lakes are, in order, Canandaigua, Keuka, Seneca, Cayuga, Owasco, Skaneateles, and Oneida. These seven lakes include a water surface of approximately 280 square miles, increased by four smaller lakes—Cross, Onondaga, Otisco, and Cazenovia—to about 295 square miles. The larger of the lakes, Oneida, Cayuga, and Seneca, are used for steam-towing navigation, having connection with the Erie and Oswego canals. Cayuga and Seneca lakes are noted for their depth and for the abrupt slopes of their beds The influence of the lakes on Oswego River is of the utmost importance in contributing to the steadiness of its flow.

A fall of 100 feet in the course of the main river is largely utilized by seven dams, which also partly canalize the stream. The intervening stretches are covered by the Oswego Canal, which draws its water supply from the river.

OSWEGO RIVER AT BATTLE ISLAND, N. Y.

This station was established September 14, 1900, and was discontinued April 30, 1906. It was located 3 miles above the mouth of the river and 0.6 mile below the State dam at Battle Island. The conditions at this station and the bench marks are described in Water-

Supply Paper No. 170, page 74, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Oswego River at Battle Island, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.
1	5.9	6.05	5.15	7.4	17	5.8	4.88	5.05	8.05
2	6.35	5.85	5.2	7.65	18	5.75	4.68	.....	8.0
3	6.65	5.0	5.05	7.5	19	5.8	4.82	5.05	8.0
4	6.55	5.15	5.45	7.5	20	5.55	4.82	.....	7.85
5	6.4	5.15	5.92	7.5	21	5.45	4.88	.....	7.78
6	6.25	5.1	5.8	7.5	22	6.2	4.88	.....	6.55
7	5.75	5.25	5.8	7.4	23	6.7	4.9	.....	6.95
8	6.5	5.15	5.7	7.3	24	6.95	4.85	.....	6.8
9	6.6	5.0	5.65	7.8	25	6.9	4.75	.....	6.65
10	6.4	5.0	5.65	8.4	26	6.85	5.5	.....	6.5
11	5.8	4.7	5.0	8.3	27	6.6	5.3	6.2	6.45
12	5.75	5.0	5.65	8.3	28	6.1	5.1	6.8	6.4
13	5.5	4.92	5.5	8.2	29	6.4	.....	7.05	6.15
14	5.25	4.9	5.15	8.05	30	6.3	.....	7.2	6.55
15	5.7	4.82	5.0	7.95	31	6.15	.....	7.3	.....
16	5.75	4.82	5.0	8.25					

NOTE.—Gage height below 5.0 feet on March 18 and March 20 to 26. River does not freeze over entirely at gage: shore ice extends from 10 to 50 feet out, leaving an open channel in center of stream. The frozen period is affected by needle ice at times. Ice period for 1906, from January 31 to February 26, ice 0.5 to 0.8 foot thick at gage. Backwater from ice jam below gage on February 26 to 28. During frozen period readings were taken to water surface through a hole cut in ice.

Rating table for Oswego River at Battle Island, N. Y., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.00	7,300	5.70	8,690	6.40	10,120	7.20	11,820
5.10	7,490	5.80	8,890	6.50	10,330	7.40	12,260
5.20	7,690	5.90	9,090	6.60	10,550	7.60	12,700
5.30	7,890	6.00	9,300	6.70	10,750	7.80	13,150
5.40	8,090	6.10	9,500	6.80	10,950	8.00	13,580
5.50	8,290	6.20	9,710	6.90	11,170	8.20	14,020
5.60	8,490	6.30	9,920	7.00	11,390	8.40	14,470

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1900–1904, and is fairly well defined.

Monthly discharge of Oswego River at Battle Island, N. Y., for 1906.

[Drainage area, 4,990 square miles.]

Month.	Discharge in second-feet.			Run-off	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile	Depth in inches.
January	11,300	7,790	9,610	1.93	2.22
March [a]	12,000	7,200	8,670	1.74	1.55
April	14,500	9,610	12,400	2.48	2.77

[a] March 1–19, 27–31; discharge for March 18 estimated.

NOTE.—Values for 1906 are excellent.

CANANDAIGUA OUTLET AT ALLOWAY, N. Y.

A temporary gage was erected by F. P. Williams, at the highway bridge across the Canandaigua Outlet at Alloway September 18, 1906. The gage consists of a board divided to feet and tenths, secured vertically to the northwest wing wall of the bridge. The zero mark is at

elevation 408.0 and is referred to a bench mark consisting of a chisel draft on the northwest abutment of the bridge having an approximate elevation of 420.25 feet. The gage was read each day from September 18 to October 30, 1906, inclusive, by George Tuscher; observations were taken at 7 a. m., at noon, and at 6 p. m. The mean daily elevation has been obtained by adding together twice the morning reading, plus the noon reading, plus twice the afternoon reading, and dividing the sum by 5. Measurements by means of surface floats were made at a point about 500 feet below the bridge. Current-meter measurements are made on the downstream side of the Alloway Bridge. Owing to regulation by storage in Canandaigua Lake, the flow in the outlet ordinarily fluctuates but little during the day. There are, however, a number of dams in the outlet by which the flow may be temporarily held back as pondage.

Daily gage height, in feet, of Canandaigua Outlet at Alloway, N. Y., for 1906.

Day.	Sept.	Oct.	Day.	Sept.	Oct.
1		0.76	16		0.82
2		.86	17		.90
3		.86	18	0.52	.78
4		.80	19	.56	.90
5		.80	20	.66	1.90
6		.78	21	.78	1.56
7		1.52	22	.78	1.32
8		1.00	23	.96	1.16
9		.86	24	.90	1.16
10		.94	25	.80	1.22
11		1.04	26	.82	1.20
12		1.10	27	.62	1.20
13		1.10	28	.62	1.26
14		.82	29	.80	1.26
15		.76	30	1.08	1.16

SENECA LAKE AT GENEVA, N. Y.

A gaging station was established at the foot of Seneca Lake, October 18, 1905. The record is furnished by the department of public works, Geneva, N. Y., C. T. Church, superintendent. Readings are taken Wednesday night of each week by the engineer, Reynolds Hill, after the pumps are stopped.

The station is at the pump house of the city water supply, about 2 miles south of Geneva, along the west shore of the lake. Two 5-foot sections of galvanized iron gage, divided into feet and tenths, are fastened to a center post in the intake well; elevation of zero referred to United States Geological Survey tablet at Geneva, 440.78.

Drainage areas tributary to Seneca Lake.

	Square miles.
Keuka Lake:	
Above outlet	161
Water surface	17.5
Between Keuka Outlet and Seneca Lake	24.80
Total	203.3

	Square miles.
Catherine Creek:	
Above Montaur Falls	66.5
Montaur Falls to Seneca Lake	29.9
Total	96.4
Glen Creek	23.5
All other drainage	317.8
Total	641
Water surface of Seneca Lake	67.2
Grand total	708.2

Gage heights of Seneca Lake at Geneva, N. Y., 1905–6.

1905.	Feet.
October 25	5.0
October 31	4.8
November 8	4.6
November 15	5.0
November 22	4.3
November 29	4.3
December 6	4.5
December 13	4.4
December 21	4.5
December 30	4.7
1906.	
January 3	4.7
January 10	4.8
January 17	4.6
January 24	4.7
January 31	4.7
February 7	4.5
February 14	4.4
February 21	4.4
February 28	4.3
March 7	4.4
March 14	4.4
March 21	3.9
March 28	4.3
April 4	4.7
April 11	4.9
April 18	5.1
April 25	5.3
May 2	5.1
May 9	5.1
May 16	5.1
May 23	5.1

1906.	Feet.
May 30	5.2
June 6	5.2
June 13	5.2
June 20	5.3
June 27	5.3
July 4	5.4
July 11	5.5
July 18	5.4
July 26	5.4
August 1	5.3
August 8	(a)
August 15	(a)
August 22	(a)
August 29	5.5
September 5	5.4
September 12	5.2
September 19	5.0
September 26	4.9
October 3	4.8
October 10	4.8
October 17	4.7
October 24	4.8
October 30	4.5
November 7	4.4
November 14	4.4
November 21	4.6
November 28	4.5
December 5	4.3
December 12	4.4
December 19	4.5
December 26	4.5

[a] Water over gage.

CAYUGA LAKE AT ITHACA, N. Y.

A gaging station was established at the head of Cayuga Lake August 6, 1905. A staff gage is used, attached to the wall of the breakwater about 150 feet from the light-house. Gage readings are taken once each day during the open season and once a week during the winter by Fred Thomas.

Gage height of Cayuga Lake at Ithaca, N. Y., for 1906.

	Feet.		Feet.
January 6	1.35	July 7	2.1
January 13	1.25	July 14	2.2
January 20	.85	July 21	2.3
January 27	1.10	August 4	2.15
February 3	.65	August 11	2.35
February 10	.55	August 18	2.2
February 17	.40	August 25	2.1
February 24	.35	September 1	2.15
March 3	.50	September 8	2.0
March 10	.70	September 15	1.95
March 17	.65	September 22	1.9
March 24	.35	September 29	1.85
March 31	1.60	October 1	1.85
April 7	1.85	October 6	1.7
April 14	2.30	October 13	1.4
April 21	2.15	October 20	1.65
April 28	1.65	October 27	1.7
May 1	1.65	October 31	1.75
May 5	1.70	November 3	1.3
May 12	1.50	November 10	1.25
May 19	1.35	November 17	.95
May 26	1.10	November 24	1.35
June 2	1.40	November 30	1.2
June 9	1.35	December 1	1.25
June 16	1.50	December 8	1.3
June 23	1.75	December 15	1.4
June 30	1.90	December 29	1.35
July 1	2.1		

SENECA RIVER AT BALDWINSVILLE, N. Y.

This station was established November 12, 1898. It is located at the State dam in Baldwinsville, 12 miles along the river from the junction of Seneca and Oneida rivers. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 76, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Seneca River at Baldwinsville, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4,471	3,474	3,028	5,402	3,984	3,434	2,936	2,131	1,996	2,304	3,444	3,957
2	4,448	3,248	2,902	5,924	3,928	3,237	3,658	2,096	1,609	2,263	3,294	3,659
3	4,026	2,229	3,050	5,940	3,989	2,973	3,508	2,106	2,251	2,198	3,277	4,025
4	4,240	2,669	2,993	6,091	4,179	3,336	3,305	2,073	1,994	2,201	2,937	3,476
5	4,520	3,276	3,823	6,107	4,421	3,137	3,745	1,951	1,981	2,259	3,345	3,064
6	4,394	2,759	3,889	6,083	3,733	3,137	3,571	2,728	1,984	2,493	3,265	3,476
7	3,399	2,681	3,889	5,966	4,493	3,148	3,415	2,670	1,978	1,609	3,218	4,162
8	3,670	2,609	3,777	5,272	4,352	3,148	3,246	2,670	1,887	2,471	3,123	3,945
9	3,397	2,475	3,744	5,690	4,233	3,241	3,759	2,508	1,472	2,655	3,017	3,097
10	3,126	2,491	3,770	6,124	4,288	2,778	3,680	2,508	1,978	2,709	3,062	3,609
11	3,139	1,875	3,203	6,087	4,131	3,256	3,635	2,356	1,994	2,606	2,665	3,667
12	3,156	2,434	3,583	6,310	4,006	3,215	3,548	1,950	2,032	2,603	3,199	3,633
13	3,251	2,491	3,409	6,310	3,617	3,111	3,398	2,440	2,032	2,606	3,452	3,666
14	3,127	2,491	3,220	6,352	4,133	3,097	3,205	2,381	2,032	2,232	3,494	4,283
15	3,454	2,441	3,029	6,999	4,018	2,977	2,886	2,251	1,909	2,708	3,705	4,160
16	3,472	2,424	3,281	6,629	4,103	2,968	3,135	2,251	1,342	2,645	3,867	4,310
17	3,522	2,494	3,031	6,505	4,133	3,118	3,163	2,183	2,016	2,576	3,850	4,840
18	3,572	2,134	2,628	6,375	3,991	3,979	2,988	2,107	2,002	2,568	3,635	4,857
19	3,572	2,651	2,976	6,245	3,910	4,205	2,837	1,771	2,032	2,533	4,139	4,857
20	3,535	2,461	2,876	6,121	3,252	4,233	3,020	2,124	2,032	2,733	4,327	4,655
21	3,287	2,742	2,646	5,918	3,777	4,233	2,875	2,311	2,032	2,485	4,381	4,645
22	3,826	3,005	2,719	5,142	3,734	4,273	2,519	2,300	1,909	3,120	4,649	4,679
23	3,884	3,107	2,878	5,485	3,731	4,184	2,841	2,267	1,502	3,293	4,730	3,937
24	4,061	3,435	2,773	5,311	3,460	3,817	2,561	2,210	2,067	3,343	4,955	4,224
25	4,006	3,331	2,473	5,116	3,460	4,122	2,613	2,117	2,084	3,393	4,703	3,636
26	3,851	3,695	2,743	4,717	3,210	4,178	2,487	1,703	2,084	3,343	4,595	3,657
27	3,888	3,730	3,574	4,516	3,027	3,768	2,164	2,345	2,007	3,258	4,755	3,473
28	3,438	3,253	4,287	4,605	3,337	3,563	2,134	2,011	2,115	2,910	4,633	3,528
29	3,490	.....	4,922	3,645	3,554	3,373	1,708	2,011	2,004	3,429	4,571	3,720
30	3,413	.....	5,227	4,334	3,415	3,331	2,309	1,989	1,532	3,443	4,395	3,651
31	3,313	.....	5,563	.....	3,348	.....	2,203	1,989	.....	3,393	.....	4,237

NOTE.—There is considerable leakage at this station, which has been quite well determined by current meter measurements.

Monthly discharge of Seneca River at Baldwinsville, N. Y., for 1906.

[Drainage area, 3,100 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	4,520	3,130	3,680	1.19	1.37
February	3,730	1,880	2,790	.900	.94
March	5,500	2,470	3,420	1.10	1.27
April	6,630	3,640	5,680	1.83	2.04
May	4,490	3,030	3,840	1.24	1.43
June	4,280	2,780	3,480	1.13	1.26
July	3,760	1,710	3,000	.968	1.12
August	2,730	1,700	2,210	.713	.82
September	2,250	1,340	1,930	.623	.70
October	3,440	1,610	2,720	.877	1.01
November	4,960	2,660	3,820	1.23	1.37
December	4,860	3,060	3,960	1.28	1.48
The year	6,630	1,340	3,380	1.09	14.81

NOTE.—Above values are fair.

SKANEATELES LAKE OUTLET AT WILLOW GLEN, N. Y.

This station was established March 10, 1895. It is located in the village of Willow Glen, 1.5 miles below the foot of Skaneateles Lake. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 79, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Skaneateles Lake outlet at Willow Glen, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	30	34	30	34	72	67	67	67	70	67	57	57
2	30	32	30	30	77	67	67	77	70	67	57	57
3	30	32	34	30	83	67	67	77	72	57	57	57
4	32	32	30	34	77	67	67	100	70	57	57	57
5	34	30	30	34	77	67	67	88	70	57	57	57
6	32	30	30	34	77	70	67	88	70	57	57	67
7	30	32	30	32	77	67	67	88	70	57	57	67
8	30	34	30	32	67	70	67	88	70	57	57	60
9	30	32	30	38	71	67	67	88	70	57	57	60
10	30	30	30	38	67	70	67	77	70	57	57	60
11	30	30	30	36	67	67	67	77	70	57	60	60
12	30	30	30	34	67	67	67	77	70	57	60	60
13	30	30	30	34	70	67	67	77	67	57	60	60
14	30	30	30	34	67	67	67	77	67	57	60	60
15	30	30	30	38	67	67	67	77	67	57	60	60
16	30	30	30	36	67	70	67	77	67	57	60	57
17	30	30	30	34	67	72	70	77	67	57	62	57
18	30	30	32	34	67	72	67	77	67	57	62	57
19	30	30	34	34	67	70	67	72	67	60	60	57
20	30	30	32	34	67	67	67	83	67	57	60	60
21	30	30	30	34	67	67	67	77	67	60	57	57
22	30	30	30	34	67	67	67	72	67	57	57	57
23	32	30	30	34	67	67	67	72	70	57	57	57
24	32	30	30	34	67	67	67	72	67	57	57	57
25	32	32	30	34	67	67	67	72	67	57	57	57
26	32	30	30	34	67	67	67	70	67	57	57	57
27	32	30	34	34	70	67	67	70	67	57	57	57
28	32	30	34	34	70	67	67	70	67	57	57	30
29	32	.....	32	34	67	67	67	70	67	57	57	30
30	32	.....	36	62	67	67	67	70	67	57	57	38
31	32	.....	38	.....	67	.....	67	70	.....	57	.....	41

Monthly discharge of Skaneateles Lake outlet at Willow Glen, N. Y., for 1905–6.

[Drainage area, 74.2 square miles.]

Month.	Discharge in second-feet.			Run-off.[a]	
	In outlet.	Through conduit.	Total.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
August	62.8	18.4	81.2	1.09	1.26
September	76.7	18.6	95.3	1.28	1.43
October	92.2	18.6	110.8	1.49	1.72
November	89.5	17.7	107.2	1.44	1.61
December (1-16)	58.8	17.8	76.6	1.03	1.19
1906.					
January	30.9	18.1	49.0	.660	.76
February	30.7	19.7	50.4	.679	.71
March	31.2	19.7	50.9	.686	.79
April	35.1	19.4	54.5	.735	.82
May	69.7	19.2	88.9	1.20	1.38
June	67.8	19.2	87.0	1.17	1.30
July	67.1	19.2	86.3	1.16	1.34
August	77.2	18.9	96.1	1.30	1.50
September	68.4	18.6	87.0	1.17	1.30
October	57.8	18.6	76.4	1.03	1.19
November	58.1	18.6	76.7	1.03	1.15
December	55.6	.....	.....	.....	.....

[a] Including diversion for water supply of Syracuse. The flow during January, February, and March was slightly affected by ice. On account of slight changes in conditions at weir, values for 1906 are rated as approximate.

ONEIDA RIVER NEAR EUCLID, N. Y.

This station was established August 30, 1902. It is located 7 miles upstream from Three River Point. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 80, where are given also references to publications that contain data for previous years.

Discharge measurements of Oneida River near Euclid, N. Y., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 17	C. C. Covert	245	1,400	3.30	3,490
August 10	do	240	1,010	4.71	1,280
September 21	E. F. Weeks	238	867	[a] 5.30	705
October 18	do	234	860	[a] 5.30	906

[a] Gage heights uncertain.

Daily discharge, in second-feet, of Oneida River near Euclid, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,720	5,240	3,270	4,900	4,180	2,380	2,070	1,570	866	845	1,090	1,980
2	4,030	5,240	3,100	5,240	4,070	2,380	2,070	1,380	783	783	1,120	1,980
3	4,030	5,130	3,370	5,240	3,920	2,340	2,070	1,350	742	762	1,190	1,870
4	4,130	4,900	3,420	5,350	4,130	2,260	2,210	1,140	742	804	1,090	1,970
5	4,230	4,680	3,570	5,350	4,180	2,250	2,340	907	742	824	1,090	2,260
6	4,180	4,280	3,720	5,600	4,240	2,110	2,210	907	742	907	1,090	2,370
7	3,980	4,180	3,720	5,470	4,070	2,250	2,180	907	742	845	1,090	2,370
8	3,830	3,980	3,570	5,470	3,920	2,420	2,180	990	742	949	1,090	2,540
9	4,030	3,620	3,470	6,580	3,770	2,590	2,040	990	742	1,070	1,090	2,580
10	4,230	3,620	3,420	6,970	3,560	2,630	2,000	990	824	907	1,090	2,750
11	4,030	3,420	3,420	6,330	3,560	2,630	1,920	907	742	990	1,120	2,880
12	4,030	3,370	3,220	6,330	3,560	2,510	1,920	845	658	990	1,190	2,880
13	3,830	3,220	3,220	6,520	3,460	2,630	1,780	990	742	990	1,170	2,710
14	3,620	3,050	3,220	6,710	3,510	2,630	1,780	1,300	658	969	1,090	2,630
15	3,620	2,880	3,100	6,710	3,670	2,630	1,780	1,240	658	907	1,020	2,630
16	3,620	2,880	2,880	6,710	3,460	2,550	1,740	1,170	658	928	1,120	2,670
17	3,570	2,790	2,880	6,970	3,460	2,800	1,640	1,090	658	1,020	1,190	2,710
18	3,620	2,710	2,880	6,840	3,260	2,800	1,640	1,090	637	1,090	1,270	2,710
19	3,520	2,540	2,790	6,840	3,210	2,760	1,600	1,140	495	1,120	1,300	2,710
20	3,570	2,540	2,710	6,580	3,110	2,590	1,500	1,300	679	1,140	1,330	2,830
21	3,880	2,580	2,630	6,330	2,980	2,420	1,500	1,270	742	990	1,500	2,880
22	4,230	2,540	2,630	6,330	2,940	2,250	1,500	1,190	742	969	1,570	2,880
23	4,740	2,790	2,540	6,210	2,800	2,210	1,500	1,090	762	949	1,300	2,880
24	4,840	2,880	2,370	6,025	2,630	2,180	1,450	1,070	824	949	1,300	3,050
25	5,180	3,000	2,370	5,840	2,590	2,070	1,400	990	824	949	1,450	2,960
26	5,350	3,140	2,410	5,545	2,470	2,070	1,380	990	824	949	1,640	2,670
27	5,350	2,920	2,790	5,295	2,510	2,070	1,300	949	824	949	1,640	2,500
28	5,240	3,100	3,570	5,130	2,680	2,070	1,300	907	824	1,020	1,680	2,370
29	5,240	.....	3,930	4,955	2,760	2,070	1,400	949	824	1,090	1,780	2,230
30	5,130	.....	4,450	4,680	2,590	2,070	1,710	907	886	1,090	1,780	2,580
31	4,900	.....	4,790	.....	2,470	.....	1,920	866	.....	1,090	.....	2,710

NOTE.—During January, February, and a part of March the river was partly frozen above dam, but not enough to modify flow.

Monthly discharge of Oneida River near Euclid, N. Y., for 1906.

[Drainage area, 1,310 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	5,350	3,570	4,240	3.24	3.74
February	5,240	2,540	3,470	2.65	2.76
March	4,790	2,370	3,200	2.44	2.81
April	6,970	4,680	5,970	4.56	5.09
May	4,240	2,470	3,350	2.56	2.95
June	2,800	2,070	2,390	1.83	2.04
July	2,340	1,300	1,780	1.36	1.57
August	1,570	866	1,080	.824	.950
September	886	495	744	.568	.634
October	1,140	762	962	.734	.846
November	1,780	1,020	1,280	.977	1.09
December	5,050	1,870	2,570	1.96	2.26
The year	6,970	495	2,570	1.98	26.74

NOTE.—Above values are good.

ONEIDA CREEK AT KENWOOD, N. Y.

A report of the flow of this stream during the latter portion of the low-water season of 1906 has been furnished by the Oneida Community. The record includes the flow through a 24-inch Hercules wheel and a 24-inch Camden water wheel, as well as the flow over the dam when any occur. The Camden water wheel was little used during this period. The water was drawn below crest level of Sunset Lake storage pond and nearly the entire twenty-four hour flow of the stream passed through the wheels during the ten and one-fourth hours daily run. No adequate records were kept during the first three weeks of September. The run of the mill, however, indicates that the flow was considerably less than during the period covered by the record. A gaging record of this stream in 1900 showed a minimum flow for several days of 13 to 15 second-feet, or an average of 0.222 second-foot per square mile from a tributary drainage area of 63 square miles.

Discharge of Oneida Creek at Kenwood, N. Y., for 1906.

	Second-feet.		Second-feet.
September 22	22.5	October 10	19.6
September 24	19.0	October 11	23.5
September 25	17.9	October 12	23.2
September 26	17.3	October 13	24.5
September 27	15.0	October 14	19.2
September 28	13.8	October 15	32.3
September 29	16.2	October 16	17.9
October 1	19.3	October 17	16.1
October 2	13.8	October 18	16.1
October 3	13.8	October 19	17.3
October 5	21.0	October 20	16.9
October 6	26.2	October 21	136.0
October 7	61.5	October 22	61.7
October 8	46.0	October 23	39.4
October 9	24.7	October 24	24.2

CHITTENANGO CREEK AT CHITTENANGO, N. Y.

This station was established May 22, 1901. It is located at the Main Street Bridge in the village of Chittenango and is one-half mile above the State dam diverting water for the supply of the summit level of Erie Canal. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 82, where are given also references to publications that contain data for previous years.

Discharge measurements of Chittenango Creek at Chittenango, N. Y., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec. ft.*
April 16	E. F. Weeks	58	170	2.60	329
April 21	do	57	138	2.11	201
November 7	do		101	1.52	75

Daily gage height, in feet, of Chittenango Creek at Chittenango, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.05	1.75	1.55	2.05	1.55	1.85	2.2	1.4	1.0	1.6	1.6	1.4
2	1.95	1.55	1.55	1.95	1.85	1.75	2.0	1.5	1.0	1.6	1.5	1.6
3	1.95	1.45	2.35	2.05	2.4	1.65	1.8	1.5	1.1	1.4	1.4	1.6
4	2.3	1.5	2.65	2.2	2.25	1.45	2.0	1.4	1.0	1.5	1.6	1.6
5	2.2	1.4	2.0	2.5	2.35	1.35	1.8	1.4	1.1	1.4	1.6	1.6
6	2.15	1.55	1.75	2.45	2.15	1.25	1.6	1.4	1.2	1.6	1.5	2.5
7	1.95	1.45	1.55	2.35	1.95	1.45	1.6	1.5	1.1	1.6	1.6	1.8
8	2.0	1.35	1.55	2.3	1.75	2.00	1.5	1.6	1.2	1.5	1.5	1.7
9	1.95	1.45	1.45	2.35	1.75	1.95	1.4	1.4	1.2	1.5	1.6	1.6
10	1.95	1.45	1.55	2.95	1.75	1.75	1.6	1.4	1.2	1.6	1.6	1.6
11	2.0	1.35	1.6	2.8	1.85	1.35	1.4	1.4	1.2	1.6	1.7	1.6
12	2.0	1.45	1.55	2.45	1.8	1.75	1.5	1.4	1.2	1.5	1.8	1.6
13	1.95	1.35	1.45	2.25	1.95	1.65	1.4	1.4	1.0	1.4	1.7	1.6
14	1.9	1.45	1.5	2.4	2.15	1.55	1.4	1.4	1.0	1.6	1.6	1.8
15	1.9	1.45	1.4	2.85	1.85	1.55	1.4	1.2	1.2	1.6	1.6	3.2
16	2.0	1.35	1.35	2.65	1.65	1.8	1.2	1.2	1.2	1.6	1.6	2.4
17	1.95	1.45	1.4	2.35	1.6	2.1	1.4	1.2	1.2	1.6	1.6	1.8
18	2.05	1.45	1.45	2.25	1.55	2.75	1.4	1.2	1.3	1.8	2.4	1.6
19	1.95	1.25	1.5	2.2	2.05	2.8	1.2	1.2	1.2	1.6	2.2	1.4
20	2.05	1.3	1.4	2.1	1.85	2.5	1.2	1.4	1.5	1.6	1.8	1.2
21	2.3	2.1	1.35	1.95	1.65	2.2	1.2	1.6	1.6	1.6	1.6	1.6
22	2.55	2.3	1.45	1.85	1.45	2.05	1.2	1.5	1.7	1.6	1.6	1.8
23	2.7	1.85	1.5	1.75	1.45	2.5	1.2	1.4	1.6	1.6	1.6	1.8
24	2.55	1.85	1.45	1.7	1.95	2.45	1.2	1.2	1.5	1.8	1.4	1.6
25	2.1	2.1	1.55	1.6	1.35	2.25	1.2	1.2	1.4	1.9	1.2	1.6
26	1.95	2.0	1.9	1.7	1.45	2.05	1.2	1.2	1.5	2.0	1.5	1.5
27	2.05	1.75	3.7	1.6	3.05	1.95	1.2	1.0	1.6	1.8	1.8	1.4
28	1.85	1.55	3.15	1.55	2.85	2.15	1.2	1.0	1.5	1.8	1.6	1.4
29	1.75	.....	2.25	1.6	2.65	2.05	1.3	.8	1.6	2.0	1.4	1.5
30	1.95	.....	3.15	1.65	2.45	2.15	1.2	1.0	1.6	1.8	1.4	.....
31	1.85	.....	2.75	.....	2.15	.....	1.2	1.0	.....	1.6	.....	.....

NOTE.—There was no ice obstruction previous to January 23. After this date there was some shore ice and some ice at gage, varying from 0.25 to 0.6 foot thick, but the stream was not entirely closed during the winter. During the frozen period gage heights were taken to water surface through a hole in the ice.

Rating table for Chittenango Creek at Chittenango, N. Y., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	20	1.60	85	2.40	275	3.20	630
0.90	25	1.70	100	2.50	315	3.30	680
1.00	30	1.80	115	2.60	355	3.40	735
1.10	35	1.90	135	2.70	395	3.50	790
1.20	40	2.00	155	2.80	440	3.60	850
1.30	50	2.10	180	2.90	485	3.70	910
1.40	60	2.20	210	3.00	530		
1.50	70	2.30	240	3.10	580		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-1906, and is well defined.

Monthly discharge of Chittenango Creek at Chittenango, N. Y., for 1906.

[Drainage area, 79 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	395	108	177	2.24	2.58
February	240	45	87.8	1.11	1.16
March	910	55	169	2.14	2.47
April	508	78	217	2.75	3.07
May	555	45	166	2.10	2.42
June	440	45	164	2.08	2.32
July	210	40	68.9	.872	1.01
August	85	20	52.6	.666	.77
September	100	30	51.7	.654	.73
October	155	60	91.6	1.16	1.34
November	275	40	92.7	1.17	1.30
December	630	30	113	1.43	1.65
The year	910	20	121	1.53	20.82

NOTE.—Values are rated as follows: January, March to July, and October to December, good; February, August, and September, fair.

SALMON RIVER BASIN.

DESCRIPTION OF BASIN.

Salmon River rises in the southwestern part of Lewis County, N. Y., flows first southward then northwestward, and enters Lake Ontario near Port Ontario. The basin above the gaging station is rolling and very sandy, rock lying near the surface in the upper part of the watershed, where there are also extensive tracts of original forest. The region is subject to heavy falls of snow, which sometimes accumulates in the forest areas to a depth of several feet and melts gradually during March and April, feeding the stream.

Drainage areas tributary to Salmon River.[a]

	Area.	Total area.
	Sq. miles.	*Sq. miles.*
Salmon River above Osceola	44.04	44.04
Salmon River from Osceola to junction of North Branch	26.03	70.07
North Branch Salmon River:		
Above Mill Creek	83.05	.....
Mill Creek	14.25	.....
From Mill Creek to mouth	2.35	.....
Total	99.65	169.72
Salmon River from North Branch to Salmon Falls	23.70	193.42
Salmon River from Salmon Falls to Beaver Dam Brook	6.05	199.47
Beaver Dam Brook	15.44	214.91
Salmon River from Beaver Dam Brook to Sandbank	1.03	215.94
Salmon River from Sandbank to Orwell Brook	1.28	217.22
Orwell Brook	23.13	240.35
Salmon River from Orwell Brook to Trout Brook	2.10	242.45
Trout Brook	14.40	256.85
Salmon River from Trout Brook to Fox Bridge	1.92	258.77
Salmon River from Fox Bridge to Pulaski	7.49	266.26
Salmon River from Pulaski to mouth	5.90	272.16

[a] From U. S. Geological Survey topographic maps.

SALMON RIVER NEAR PULASKI, N. Y.

This station was established September 5, 1900. It is located at Fox Bridge, near Pulaski, N. Y. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 84, where are given also references to publications that contain data for previous years.

Discharge measurements of Salmon River near Pulaski, N. Y., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 18	E. F. Weeks	182	787	5.60	3,980
August 18	C. C. Covert	170	198	2.40	94
September 20	do	158	176	2.25	54
October 25	Barrows and Covert	175	312	3.20	450

Daily gage height, in feet, of Salmon River near Pulaski, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.18	3.65	3.42	4.42	4.02	2.92	4.45	2.62	2.30	3.30	3.22	3.50
2	3.78	3.25	3.30	4.15	3.90	2.88	3.80	2.52	2.30	2.95	3.10	3.15
3	3.68	3.18	3.60	4.00	4.38	2.82	3.30	2.55	2.38	2.78	3.05	2.92
4	3.90	3.20	4.25	4.25	4.65	2.80	3.75	2.65	2.65	2.50	3.00	3.10
5	4.00	3.25	4.12	4.85	4.82	2.78	4.18	2.70	2.55	2.58	3.00	3.10
6	3.90	3.12	3.72	4.45	4.32	2.95	3.45	2.70	2.40	2.68	2.98	3.18
7	3.50	3.15	3.65	4.12	3.90	2.92	3.15	2.75	2.38	3.82	2.92	3.40
8	3.50	3.20	3.50	4.00	3.60	3.65	2.95	2.65	2.40	3.50	2.88	3.25
9	3.50	3.20	3.42	4.08	3.55	4.35	2.88	2.55	2.32	3.10	2.85	3.22
10	3.40	3.20	3.42	4.08	3.80	3.65	2.90	2.5	2.30	3.55	2.92	3.15
11	3.42	3.18	3.20	4.20	3.78	3.45	3.32	2.62	2.30	3.48	3.18	3.10
12	3.50	3.15	3.25	4.22	3.55	3.18	3.15	2.68	2.25	3.22	3.40	3.00
13	3.40	3.15	3.10	4.50	3.70	2.98	2.90	2.58	2.25	3.05	3.25	3.00
14	3.35	3.20	3.08	4.72	5.10	2.95	2.75	2.50	2.30	2.98	3.12	3.05
15	3.35	3.18	3.08	6.90	4.48	2.82	2.70	2.50	2.25	2.90	2.98	3.25
16	3.38	3.12	3.05	6.35	3.88	2.80	2.65	2.45	2.25	2.80	2.98	4.50
17	3.35	3.15	3.02	5.75	3.58	2.80	2.68	2.42	2.28	2.75	2.95	4.30
18	3.35	3.12	2.95	5.58	3.48	2.80	2.70	2.38	2.25	2.70	3.02	3.70
19	3.32	3.08	3.00	5.52	3.32	2.88	2.65	2.35	2.20	2.62	4.08	3.32
20	3.28	3.08	3.00	5.60	3.20	2.82	2.65	2.35	2.25	4.15	3.88	3.25

Daily gage height, in feet, of Salmon River near Pulaski, N. Y., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	3.68	3.38	2.98	5.15	3.12	2.72	2.70	2.38	2.25	3.95	3.52	3.[illegible]
22	4.40	3.95	2.98	5.10	3.10	2.70	2.72	2.45	2.32	3.45	3.58	3.18
23	5.75	3.92	2.92	5.02	3.02	2.78	2.68	2.45	2.58	3.18	3.52	3.[illegible]
24	6.80	3.85	2.98	4.45	3.00	2.80	2.65	2.38	2.72	3.02	3.40	2.95
25	5.40	4.05	2.95	4.20	2.98	2.78	2.60	2.35	2.48	3.12	3.25	3.02
26	4.75	4.30	2.98	4.02	3.00	2.70	2.52	2.35	2.40	3.42	3.22	3.18
27	4.40	3.80	4.45	4.02	3.28	2.62	2.50	2.35	2.40	3.50	3.92	3.[illegible]
28	4.12	3.55	5.28	4.08	3.75	2.60	2.50	2.35	2.48	3.48	4.60	3.[illegible]
29	3.68	.....	5.2	4.00	3.30	2.68	2.50	2.35	2.45	3.75	4.05	3.[illegible]
30	3.70	.....	4.95	4.05	3.12	5.50	2.52	2.35	3.32	3.55	3.50	3.[illegible]
31	3.78	.....	4.78	.....	3.00	.....	2.65	2.30	.....	3.40	.....	3.70

NOTE. Stream not entirely closed by ice during winter period, but channel obstructed at times by needle and anchor ice.

Rating table for Salmon River near Pulaski, N. Y., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.20	46	3.40	620	4.60	1,980	5.80	4,490
2.30	67	3.50	697	4.70	2,140	5.90	4,780
2.40	93	3.60	781	4.80	2,300	6.00	5,100
2.50	124	3.70	865	4.90	2,470	6.20	5,770
2.60	161	3.80	965	5.00	2,640	6.40	6,530
2.70	204	3.90	1,060	5.10	2,840	6.60	7,340
2.80	253	4.00	1,170	5.20	3,020	6.80	8,190
2.90	307	4.10	1,300	5.30	3,240	7.00	9,070
3.00	364	4.20	1,420	5.40	3,460	7.20	10,000
3.10	422	4.30	1,550	5.50	3,700	7.40	11,000
3.20	480	4.40	1,680	5.60	3,950	7.60	12,060
3.30	550	4.50	1,830	5.70	4,200		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905 to 1906, and is fairly well defined.

Monthly discharge of Salmon River near Pulaski, N. Y., for 1906.

[Drainage area, 259 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	.....	.....	1,340	5.17	5.9[illegible]
February	.....	.....	640	2.47	2.[illegible]
March	.....	.....	880	3.40	[illegible]
April	8,620	1,180	2,350	9.07	1[illegible]
May	2,840	349	945	3.64	4.[illegible]
June	1,020	161	370	1.43	1.[illegible]
July	1,750	124	390	1.51	1.[illegible]
August	228	67	125	.483	.[illegible]
September	567	46	104	.402	.4[illegible]
October	1,360	124	519	2.00	2.[illegible]
November	1,980	280	606	2.34	2.[illegible]
December	1,830	323	554	2.14	2.[illegible]
The year	8,620	46	735	2.84	38.3[illegible]

NOTE.—Values are rated as follows: January to March, fair, on account of ice obstruction; remainder of 1906, good.

BLACK RIVER BASIN.

DESCRIPTION OF BASIN.

Black River rises in the western part of Hamilton County, N. Y., flows southwestward across Herkimer County into Oneida County, turns near Forestport and runs somewhat west of north through Lewis County to eastern Jefferson County, and then flows westward to Black River Bay, at the eastern extremity of Lake Ontario. The upper part of the basin is very rugged and mountainous and contains a large number of lakes.

The flow of the river is controlled by storage on its upper tributaries, including Beaver River at Beaver, a series of reservoirs at the headwaters of Moose River, and additional reservoirs at Forestport and on the headwaters of the main river.

Water is diverted from Black River through Forestport feeder to supply the Black River Canal at Boonville. A portion of this diverted water flows northward from Boonville and enters Black River again at Lyons Falls; the remainder flows southward through the Black River Canal and enters the Erie Canal at Rome. The amount of this diversion, which takes place during the season of canal navigation, is not recorded.

BLACK RIVER NEAR FELTS MILLS, N. Y.

This station was established August 29, 1902. It is located at the dam of the Black River Traction Company, near the village of Felts Mills. The dam is 9 miles upstream from Watertown and 7 miles upstream from the old Huntingtonville gaging station on this stream. The conditions [a] at this station and the bench marks are described in Water-Supply Paper No. 170, page 87, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Black River at Felts Mills, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7,630	5,390	2,970	7,320	4,790	3,220	3,520	1,530	880	2,360	2,240	3,070
2	7,810	4,490	2,740	6,720	4,360	1,920	6,170	1,710	1,420	2,340	2,020	2,040
3	4,640	3,190	2,440	5,230	4,790	1,920	5,280	1,430	1,350	2,010	1,540	2,700
4	4,790	3,080	4,440	4,790	5,550	1,810	5,280	1,450	1,440	1,290	1,470	2,000
5	5,080	2,740	5,390	5,080	6,030	1,920	5,990	300	1,530	1,320	2,400	1,820
6	6,030	2,540	5,080	5,230	6,540	2,040	2,760	1,620	1,560	1,370	1,530	1,610
7	4,600	2,540	4,220	5,080	6,720	2,170	2,810	1,590	1,060	1,720	1,450	2,200
8	5,550	2,350	3,560	4,440	5,550	1,920	2,290	1,790	1,260	2,380	1,440	2,020
9	5,080	2,350	3,190	5,080	4,940	2,290	2,540	1,680	890	2,190	1,500	1,750
10	3,690	2,350	2,540	4,490	4,360	2,290	2,420	1,500	980	2,190	1,350	2,260
11	3,440	2,950	2,540	4,350	4,360	2,950	2,810	1,470	980	2,600	1,470	1,780
12	3,310	2,740	3,690	4,790	4,360	3,520	3,080	1,080	700	2,500	2,410	1,860
13	3,190	2,160	2,540	5,390	3,960	3,220	2,540	1,410	1,410	2,690	2,320	1,780
14	2,680	2,160	2,540	5,870	8,010	3,220	2,040	1,440	1,380	2,120	2,230	2,390
15	2,630	2,740	2,540	6,930	8,400	2,170	1,170	1,830	1,240	1,790	2,150	1,890

[a] Owing to high water it was impossible to obtain a profile of the crest of this dam until August, 1906. Previous estimates for this station have been made from elevations taken at the ends of the crest, and the dam assumed to be level. The 1906 profile shows more or less settlement near the center; hence an increase in discharge of about 10 per cent for the same gage height over previous estimates. The dam was constructed in 1900, and the recomputations are based on the assumption that the settlement has been proportionate each year.

Daily discharge, in second-feet, of Black River at Felts Mills, N. Y., for 1906—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Dec.	Dec.
16	2,630	2,350	2,350	9,830	9,210	1,920	1,360	1,220	890	1,560	2,030	2,810
17	2,540	2,160	1,990	13,400	8,790	2,290	1,470	1,110	1,220	1,470	2,110	3,340
18	4,490	1,920	1,360	14,200	8,010	3,370	1,470	840	1,280	1,440	2,120	2,890
19	3,690	2,970	2,440	12,900	6,030	2,950	1,470	80	960	1,440	5,230	2,940
20	3,690	1,990	1,910	11,900	4,870	2,040	1,080	1,700	1,480	2,380	5,210	2,740
21	3,220	1,990	1,630	11,600	3,220	1,920	1,080	1,300	1,180	3,570	4,730	2,480
22	7,710	4,790	2,250	11,300	3,220	1,990	1,080	1,440	970	3,640	4,590	2,270
23	13,400	4,490	1,750	11,600	3,220	1,700	1,850	1,680	590	3,120	4,140	1,700
24	18,100	4,490	2,070	10,500	2,680	1,700	1,380	1,910	1,700	2,560	3,580	1,280
25	18,800	4,440	1,360	10,000	2,540	1,920	1,840	1,540	1,660	2,180	3,160	1,080
26	19,000	5,710	2,250	8,590	2,420	1,810	1,230	1,310	1,550	2,280	3,130	1,970
27	19,000	4,490	2,630	7,260	3,220	1,470	1,070	1,840	1,180	2,370	2,990	1,710
28	11,600	4,490	6,370	6,370	4,120	1,410	870	1,300	1,040	2,420	5,030	1,650
29	9,000	.....	7,630	5,450	5,100	1,430	800	1,280	860	3,740	4,500	1,630
30	6,200	.....	7,260	5,710	5,100	723	1,650	1,350	1,150	2,940	3,750	1,470
31	6,030	.....	7,440	.....	3,960	.....	1,330	1,390	.....	2,670	.....	2,390

NOTE.—The Harmon Paper Company began operations January 2, using a part of the flow; and no records were kept of run of wheels or tailrace gage until after May 1; hence the discharges for this period are considerably in error. On October 26 and 27 and November 17 and 18, the crest of dam was obstructed by logs. The following ice conditions prevailed during December, 1906: December 1 to 5, anchor ice in wheel racks, river partly frozen over; December 7, pond frozen over, ice within 75 feet of crest of dam; December 8, ice up to crest; December 21, ice frozen on crest and holding water back. December 31, ice gone from crest.

Monthly discharge of Black River at Felts Mills, N. Y., for 1906.

[Drainage area, 1,850 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	19,000	2,540	7,070	3.82	4.40
February	5,710	1,920	3,220	1.74	1.81
March	7,630	1,360	3,330	1.80	2.08
April	14,200	4,350	7,710	4.17	4.65
May	3,210	2,420	5,110	2.76	3.18
June	3,520	723	2,170	1.17	1.30
July	6,170	800	2,310	1.25	1.44
August	1,910	80	1,390	.750	.86
September	1,700	590	1,190	.643	.72
October	3,740	1,290	2,280	1.23	1.42
November	5,230	1,350	2,790	1.51	1.68
December	3,340	1,080	2,110	1.14	1.31
The year	19,000	80	3,380	1.83	24.85

NOTE. Values May to December are rated as good; prior to May the probable error is greater than 10 per cent.

MOOSE RIVER AT MOOSE RIVER, N. Y.

This station was established June 5, 1900. It is located at Moose River village. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 89, where are given also references to publications that contain data for previous years.

Discharge measurements of Moose River at Moose River, N. Y., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 7	Covert and Weeks	217	730	2.52	73
September 22	C. C. Covert	212	440	.97	23
September 23	do	215	630	1.72	382
September 24	do	213	596	1.68	34[illegible]

Daily gage height, in feet, of Moose River at Moose River, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.92	2.78	2.53	2.58	3.38	2.03	2.83	1.73	0.90	1.95	1.10	2.25
2	2.67	2.68	2.43	2.58	3.33	1.88	3.43	1.68	.80	1.20	1.50	2.00
3	2.72	2.53	2.33	2.48	4.28	1.73	2.93	1.73	.95	1.20	1.50	1.70
4	2.72	2.38	2.58	2.38	4.38	1.63	3.18	1.73	1.60	1.00	1.40	1.60
5	2.72	2.23	2.68	2.63	4.43	1.53	2.93	1.63	1.20	.90	1.40	1.40
6	2.62	2.03	2.48	2.73	4.93	1.43	2.43	1.63	.75	1.05	1.40	1.55
7	2.52	1.93	2.28	2.53	4.53	1.53	3.13	1.53	.60	1.25	1.50	1.60
8	2.52	2.03	2.13	2.33	4.23	2.38	1.78	1.28	.50	1.40	1.40	1.70
9	2.62	2.03	2.03	2.23	3.33	3.63	1.88	1.03	.50	1.30	1.50	1.55
10	2.72	2.03	2.03	2.23	3.33	3.18	1.83	1.03	.55	1.25	1.50	1.35
11	2.62	2.13	1.93	2.43	3.13	2.73	1.73	.93	.85	1.70	1.60	1.15
12	2.57	2.13	1.83	2.38	3.03	2.53	1.63	1.03	1.00	1.65	1.60	1.20
13	2.42	2.03	1.73	2.23	4.28	2.38	1.73	1.13	1.00	1.65	1.70	1.35
14	2.27	1.93	1.68	2.43	6.13	1.98	1.73	1.03	1.30	1.65	1.65	1.60
15	2.22	1.93	1.63	5.73	5.13	1.83	1.63	.93	1.00	1.45	1.70	1.70
16	2.12	2.03	1.63	5.98	4.28	1.73	1.53	.83	1.00	1.40	1.85	1.75
17	2.12	2.03	1.63	5.23	4.13	1.98	1.43	.73	.90	1.40	2.20	1.80
18	2.25	2.13	1.53	5.03	3.98	1.83	1.38	.73	.00	1.50	2.85	1.75
19	2.45	2.13	1.53	5.33	3.78	1.93	1.28	.63	.65	1.65	3.05	1.60
20	2.60	2.28	1.43	5.43	3.33	1.93	1.18	.63	.85	2.20	2.95	1.50
21	3.47	2.53	1.23	5.58	2.93	1.83	1.13	1.03	.75	2.05	2.75	1.50
22	3.97	2.78	1.43	5.83	2.63	1.83	1.03	1.23	.80	2.00	2.55	1.40
23	5.27	2.93	1.53	5.33	2.28	1.73	1.03	1.33	1.65	2.05	2.35	1.40
24	7.77	3.03	1.63	4.63	2.18	1.73	.93	1.43	1.60	1.90	2.15	1.40
25	5.27	3.08	1.73	4.28	2.08	1.78	.93	1.53	1.65	1.80	1.95	1.30
26	4.72	2.98	1.73	3.93	2.83	1.73	.93	1.53	1.25	1.70	2.15	1.30
27	4.37	2.78	2.13	3.83	3.88	1.63	.83	1.53	.95	1.80	2.50	1.30
28	4.08	2.63	2.53	3.53	3.93	1.53	.83	1.43	.75	1.90	2.75	1.20
29	3.53	.....	2.73	3.13	3.48	1.43	.83	1.33	1.15	1.80	2.95	1.20
30	3.28	.....	2.68	3.48	2.93	1.83	.93	1.33	1.90	1.60	2.55	1.20
31	2.93	.....	2.63	.....	2.43	.....	1.78	1.23	.....	1.35	.....	1.20

NOTE.—The river was not entirely closed by ice during 1906. There was considerable shore ice during the latter part of February and through March, ice going out the 4th of April. At times needle ice forms on the rifts below the gage and causes backwater. During the frozen period, gage heights were taken to water surface through a hole in the ice.

Rating table for Moose River at Moose River, N. Y., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.00	103	1.40	354	2.80	914	5.40	3,180
0.10	115	1.50	382	2.90	968	5.60	3,440
0.20	127	1.60	412	3.00	1,023	5.80	3,700
0.30	140	1.70	444	3.20	1,139	6.00	3,980
0.40	154	1.80	477	3.40	1,264	6.20	4,260
0.50	170	1.90	511	3.60	1,399	6.40	4,555
0.60	187	2.00	547	3.80	1,545	6.60	4,855
0.70	205	2.10	585	4.00	1,700	6.80	5,160
0.80	223	2.20	626	4.20	1,870	7.00	5,480
0.90	242	2.30	669	4.40	2,060	7.20	5,800
1.00	262	2.40	715	4.60	2,260	7.40	6,130
1.10	282	2.50	763	4.80	2,480	7.60	6,470
1.20	304	2.60	812	5.00	2,700	7.80	6,810
1.30	328	2.70	862	5.20	2,940		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1906, and is well defined between gage heights 1.0 foot and 5.0 feet. Measurements above gage height 6.0 feet are impossible at this station, owing to the flashy character of the stream and to large quantities of ice and logs running during high stages. Hence discharges of over 4,000 second-feet are liable to error.

Monthly discharge of Moose River at Moose River, N. Y., for 1906.

[Drainage area, 346 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	6,760	593	1,320	3.82	4.40
April	3,950	639	1,710	4.94	5.51
May	4,160	577	1,530	4.42	5.10
June	1,420	362	557	1.61	1.80
July	1,280	228	500	1.45	1.67
August	454	192	324	.936	1.08
September	511	[a] 103	267	.772	.86
October	626	242	413	1.19	1.37
November	1,050	282	580	1.68	1.87

[a] The low minimum for September was caused by the storage of water by the dam at McKeever.

NOTE.—Values are rated as follows: January to May and September, good; June to August, October, and November, excellent.

ST. LAWRENCE RIVER DRAINAGE.

GENERAL FEATURES.

St. Lawrence River receives the flow of a number of New York streams having their sources in a northerly slope of the Adirondacks and fed by the innumerable lakes with which the region is dotted. Some of these rivers, as the Grass, Raquette, and St. Regis, lie entirely within the United States; others, notably Salmon, Trout, Chateaugay, and English rivers, cross the international boundary and flow northward into the St. Lawrence in Canada, as does also Richelieu River, the outlet of Lake Champlain. The following table gives a list of the principal tributaries of the St. Lawrence in the United States, with the areas drained by them:

Drainage areas of St. Lawrence River tributaries in the United States.

	Square miles.		Square miles.
Oswegatchie River	1,609	Salmon River [a]	273
Grass River	637	Trout River [b]	129
Raquette River	1,219	Chateaugay River [b]	199
St. Regis River	910	English River [b]	53
Little Salmon River [a]	103	Lake Champlain [b]	8,187

The St. Lawrence drains, through Lake Champlain, an area of 4,56 square miles in the State of Vermont. This drainage is practically all from Missisquoi, Lamoille, and Winooski rivers and Otter Creek.

OSWEGATCHIE RIVER BASIN.

DESCRIPTION OF BASIN.

Oswegatchie River has its source in the region of lakes and timbered swamps in the southern part of St. Lawrence County, N. Y.

[a] Above junction near international boundary. [b] Above New York State line.

The largest of the lakes is Cranberry Lake, which affords valuable storage to water-power users on its outlet, East Branch of Oswegatchie River. East and West branches flow in a general northwesterly direction and unite near Talcville. From Gouverneur to Oxbow the river flows southwestward; it then turns sharply and flows northeastward to Rensselaer Falls, turns again to the northwest, receives the outlet of Black Lake at Galilee, and finally enters the St. Lawrence at Ogdensburg.

OSWEGATCHIE RIVER NEAR OGDENSBURG, N. Y.

This station was established May 16, 1903. It is located at Eel Weir Bridge, just below the junction of Oswegatchie River and Black Lake outlet. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 93, where are given also references to publications that contain data for previous years.

Discharge measurements of Oswegatchie River near Ogdensburg, N. Y., in 1903–1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1903.					
May 5	Covert and Halsey		269	4.70	1,040
May 14	H. H. Halsey		256	4.60	830
May 14	do		256	4.60	729
September 22	C. C. Covert		261	4.70	812
1904.					
April 8	Covert and Swancott		1,170	8.10	9,460
April 10	do		1,180	8.05	9,550
July 4	C. C. Covert		306	4.80	1,210
October 23	A. M. Evans		549	5.68	2,410
October 23	do		536	5.64	2,370
1905.					
March 26	Horton and Mott	269	1,200	8.02	9,240
March 26	do	269	1,230	8.15	9,010
April 14	C. C. Covert	267	1,000	7.24	7,240
April 16	do	267	975	7.12	6,930
April 17	do	267	925	6.92	6,190
1906.					
April 19	C. C. Covert	267	854	6.60	5,430
April 20	do	267	842	6.60	5,380
August 16	Covert and Weeks	240	377	4.90	987
October 27	Barrows and Covert	254	814	6.61	4,640

Daily gage height, in feet, of Oswegatchie River near Ogdensburg, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.2	7.0	5.75	6.8	5.55	5.2	4.9	4.7	4.5	4.65	6.4	6.6
2	7.4	6.85	5.4	6.65	5.4	5.1	4.9	4.7	4.5	4.7	6.35	6.55
3	7.3	6.5	5.25	6.5	5.5	5.1	4.85	4.7	4.5	4.75	6.15	6.45
4	7.2	6.15	5.25	6.55	5.55	5.0	4.9	4.95	4.5	4.8	6.0	6.25
5	7.2	6.0	5.6	6.3	5.5	5.0	5.05	5.1	4.55	4.8	5.95	6.05
6	7.1	5.9	5.7	6.1	5.7	4.9	5.3	5.3	4.75	4.95	5.85	5.9
7	7.1	5.7	5.7	6.05	5.65	4.8	5.45	5.35	4.9	5.1	5.7	5.9
8	7.1	5.55	5.65	5.9	5.55	5.25	5.55	5.2	4.9	5.3	5.7	5.95
9	6.85	5.45	5.55	5.9	5.55	5.75	5.55	5.1	4.85	5.75	5.7	5.95
10	6.8	5.4	5.45	5.9	5.5	6.2	5.5	5.0	4.8	5.75	5.55	5.8

Daily gage height, in feet, of Oswegatchie River near Ogdensburg, N. Y., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	6.65	5.3	5.4	5.95	5.5	6.4	5.5	5.0	4.8	5.75	5.4	5.8
12	6.4	5.2	5.25	6.1	5.4	6.5	5.4	4.8	4.8	6.0	5.4	5.8
13	6.35	5.1	5.2	6.15	5.4	6.6	5.4	4.8	4.8	6.1	5.65	5.65
14	6.2	5.1	5.2	6.3	5.35	6.5	5.4	4.8	4.8	6.1	5.65	5.5
15	6.05	5.1	5.15	6.2	5.55	6.4	5.4	4.75	4.8	6.15	5.4	5.55
16	5.9	5.0	5.1	6.25	5.6	6.35	5.4	4.75	4.8	6.1	5.45	5.5
17	5.9	5.0	5.1	6.25	5.95	6.15	5.3	4.7	4.8	6.1	5.4	5.7
18	5.85	4.9	5.1	6.35	5.95	6.0	5.2	4.7	4.7	6.05	5.45	5.95
19	6.1	4.9	5.1	6.45	5.9	6.0	4.95	4.6	4.7	6.0	5.65	6.15
20	5.85	4.9	5.0	6.5	5.85	5.8	4.9	4.6	4.7	6.1	5.7	5.9
21	5.85	5.0	5.0	6.5	5.85	5.65	4.9	4.6	4.6	6.1	5.7	5.8
22	6.3	5.2	4.95	6.35	5.65	5.55	4.9	4.55	4.6	6.55	6.6	5.6
23	7.15	5.65	4.9	6.3	5.6	5.4	4.9	4.45	4.6	6.65	6.45	5.8
24	7.45	5.7	4.85	6.3	5.55	5.4	4.8	4.4	4.6	6.65	6.35	5.5
25	7.8	5.8	4.75	6.25	5.4	5.4	4.8	4.4	4.6	6.7	6.35	5.6
26	7.9	5.9	4.7	6.2	5.4	5.3	4.8	4.5	4.6	6.7	6.3	5.4
27	8.1	5.85	5.0	6.2	5.15	5.15	4.8	4.5	4.6	6.6	6.3	5.3
28	7.95	5.85	5.5	6.0	5.2	5.1	4.7	4.5	4.6	6.7	6.35	5.3
29	7.9	.....	6.1	5.9	5.2	5.1	4.7	4.5	4.75	6.65	6.5	5.3
30	7.55	.....	6.65	5.9	5.25	4.9	4.7	4.5	4.7	6.45	6.55	5.3
31	7.3	.....	6.8	.....	5.2	.....	4.7	4.5	.....	6.3	.....	5.3

NOTE.—The river never freezes over at the gage owing to the swift current. Ice forming on rifts, about one-half mile below, occasionally causes backwater.

Rating table for Oswegatchie River near Ogdensburg, N. Y., for 1903–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.40	590	5.60	2,400	6.80	5,775	8.00	9,350
4.50	680	5.70	2,640	6.90	6,070	8.20	9,960
4.60	780	5.80	2,890	7.00	6,365	8.40	10,570
4.70	890	5.90	3,100	7.10	6,660	8.60	11,180
4.80	1,010	6.00	3,440	7.20	6,955	8.80	11,790
4.90	1,140	6.10	3,730	7.30	7,250	9.00	12,400
5.00	1,280	6.20	4,020	7.40	7,550	9.20	13,020
5.10	1,440	6.30	4,310	7.50	7,850	9.40	13,640
5.20	1,610	6.40	4,600	7.60	8,150	9.60	14,260
5.30	1,790	6.50	4,890	7.70	8,450	9.80	14,880
5.40	1,980	6.60	5,185	7.80	8,750	10.00	15,500
5.50	2,180	6.70	5,480	7.90	9,050		

NOTE.—The above table is applicable only for open-channel conditions. It is based on nineteen discharge measurements made during 1903-1906. Although the discharge measurements plot somewhat erratically, the curve may be considered fairly well defined owing to the constancy of conditions of flow from year to year.

Monthly discharge of Oswegatchie River near Ogdensburg, N. Y., for 1903–1906.

[Drainage area, 1,580 square miles.]

Month.	Discharge in second-feet			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1903.					
April (22-30)	4,020	1,790	2,670	1.69	0.57
May	1,520	590	903	.572	.66
June	2,180	590	1,210	.766	.85
July	1,790	680	1,220	.772	.89
August	2,890	950	2,070	1.31	1.51
September	1,010	680	876	.554	.62
October	5,480	680	3,090	1.96	2.26
November	2,400	1,010	1,660	1.05	1.17
December	1,610	890	1,060	.671	.77

Monthly discharge of Oswegatchie River near Ogdensburg, N. Y., for 1903–1906—Cont'd.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1904.					
January	3,880	780	1,400	0.886	1.02
February	1,980	1,280	1,610	1.02	1.10
March	15,300	1,610	6,150	3.89	4.48
April	14,300	4,160	7,860	4.97	5.54
May	5,480	1,790	3,260	2.06	2.38
June	2,520	780	1,360	.861	.96
July	1,610	780	1,120	.709	.82
August	1,520	680	1,020	.646	.74
September	3,750	1,140	1,460	.924	1.03
October	5,180	1,980	3,040	1.92	2.21
November	2,890	780	1,480	.937	1.05
December	1,520	680	838	.530	.61
The year	15,300	680	2,550	1.61	21.94
1905.					
January	5,620	890	1,820	1.16	1.34
February	890	680	796	.504	.52
March	15,800	680	3,750	2.37	2.73
April	15,800	2,760	7,470	4.73	5.28
May	4,160	2,180	2,960	1.87	2.16
June	5,480	1,790	4,000	2.53	2.82
July	5,480	1,440	2,770	1.75	2.02
August	3,730	1,440	2,310	1.46	1.68
September	2,400	1,140	1,710	1.08	1.20
October	3,160	1,010	1,690	1.07	1.23
November	3,160	1,610	2,210	1.40	1.56
December	6,660	1,440	3,120	1.97	2.27
The year	15,800	680	2,880	1.82	24.81
1906.					
January	9,660	3,020	6,070	3.84	4.43
February	6,360	1,140	2,520	1.59	1.66
March	5,780	890	2,030	1.28	1.48
April	5,780	3,160	4,120	2.61	2.91
May	3,300	1,520	2,280	1.44	1.66
June	5,180	1,010	2,600	1.65	1.84
July	2,290	890	1,460	.924	1.07
August	1,880	590	977	.618	.71
September	1,140	680	886	.561	.63
October	5,480	835	3,410	2.16	2.49
November	5,180	1,980	3,320	2.10	2.34
December	5,180	1,790	2,910	1.84	2.12
The year	9,660	590	2,720	1.72	23.34

NOTE.—Above values 1903–1906 are rated as good.

RAQUETTE RIVER BASIN.

DESCRIPTION OF BASIN.

Raquette River drains a long, narrow basin extending from northern Hamilton County to St. Lawrence River. Its sources are on an elevated plateau, dotted with mountains interspersed with lakes. The region is timbered, but numerous marsh and swamp areas exist, many of which are on the divide and feed streams flowing in opposite directions. The lakes of the headwaters afford ample opportunities for storage development.

Observations at the dam of the Hannawa Falls Power Company were taken from September, 1902, to March 31, 1903. The discharge has not been computed. The Sunday flow of this stream, like many

others in this State, is often held back during the low-water season while ponds at mills above are being refilled. Where there is extensive pondage of this character the resultant effect may be shown in the stream for several days.

RAQUETTE RIVER AT MASSENA SPRINGS, N. Y.

This station was established at the highway bridge at Massena Springs, September 21, 1903. Observations were continued until October 17, 1903, when the station was temporarily abandoned. It was resumed April 9, 1904. The conditions at this station and the bench marks[a] are described in Water-Supply Paper No. 170, page 94, where are given also references to publications that contain data for previous years.

Discharge measurements of Raquette River at Massena Springs, N. Y., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 19	C. C. Covert	176	954	5.38	[illegible]
April 20	do	176	975	5.45	[illegible]
August 14	Covert and Weeks	175	581	3.28	1,430
August 15	F. F. Weeks	175	426	2.5	1,010
October 27	Barrows and Covert	172	629	3.05	1,780

Daily gage height, in feet, of Raquette River at Massena Springs, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.2	6.65	5.5	4.0	5.85	5.45	3.55	3.6	2.2	2.45	3.2	4.0
2	4.75	6.45	5.15	5.1	5.75	5.5	4.0	3.45	1.5	2.4	3.5	[illegible]
3	4.8	6.25	5.1	5.2	5.55	5.35	3.9	3.15	2.1	2.35	3.5	4.75
4	5.7	5.8	5.0	4.55	5.5	5.3	2.5	2.9	2.0	2.2	2.2	5.75
5	5.8	6.2	4.65	4.15	5.5	5.35	4.15	1.8	1.95	2.1	3.15	7.0
6	5.8	5.8	4.55	4.0	5.5	5.5	4.0	2.85	1.85	2.1	3.15	7.75
7	4.4	5.75	4.45	4.0	5.5	5.4	4.1	2.9	1.8	1.6	3.0	[illegible]
8	5.65	5.95	4.6	3.75	5.5	5.55	3.65	2.8	1.8	2.05	2.4	8.5
9	5.8	6.0	4.75	4.05	5.6	6.3	3.95	2.8	1.65	2.15	3.05	8.15
10	5.7	6.1	4.9	3.95	5.45	5.95	4.0	2.9	2.8	2.2	3.25	7.85
11	5.7	5.75	4.9	3.8	5.35	6.45	4.0	2.9	2.8	2.45	3.05	8.05
12	5.55	6.5	4.75	3.7	5.55	5.9	4.0	2.05	2.7	2.5	3.4	7.35
13	5.45	6.05	4.7	3.75	5.1	5.8	4.0	2.85	2.65	2.5	3.35	[illegible]
14	4.75	6.0	4.7	3.7	6.9	5.75	3.9	2.75	2.6	2.0	3.05	7.5
15	5.55	5.9	4.7	3.05	6.45	5.7	3.25	2.35	2.6	2.5	2.75	7.5
16	5.3	5.95	4.55	5.3	6.3	5.7	4.0	2.1	1.8	2.5	2.7	7.4
17	4.95	5.95	4.45	5.1	6.25	5.65	4.0	2.25	2.6	2.6	3.05	7.7
18	5.0	5.6	4.35	5.75	6.05	5.95	4.0	2.3	2.7	2.6	2.6	[illegible]
19	5.05	5.8	4.2	5.6	5.85	5.6	4.0	1.2	2.7	2.6	4.05	6.7
20	5.3	5.7	4.2	5.35	5.05	5.35	4.0	1.95	2.7	2.6	3.95	6.9
21	5.7	5.75	4.1	5.5	5.85	5.05	3.85	1.85	2.6	2.2	3.6	[illegible]
22	9.65	5.85	4.3	5.45	5.70	4.75	3.5	1.8	2.6	2.9	3.8	6.9
23	10.6	6.0	4.6	6.1	5.05	4.55	3.05	1.75	1.7	2.9	3.8	6.9
24	9.05	6.0	4.7	5.95	5.55	4.1	3.55	1.7	2.65	2.9	3.85	6.5
25	7.5	5.85	3.45	6.05	5.45	4.0	3.4	1.7	2.7	2.85	3.45	5.7

[a] During 1906 the vertical staff gage used in previous years was replaced by a standard chain gage, length of chain 28.84 feet. All 1906 gage heights are referred to its datum which is 1 foot below that of the staff gage. Previous gage heights should have 1 foot added to correspond to those of 1906. The gage was read during 1906 by G. T. Bullum and C. A. Waitt. The bench mark is on the upstream corner of the right abutment; elevation 25.79 feet. The reference point is on the end of the needle-beam to sidewalk near the zero of gage scale; elevation 24.31 feet; elevations are above the datum of the new gage.

Daily gage height, in feet, of Raquette River at Massena Springs, N. Y., for 1906—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
26	7.3	5.8	4.7	6.0	5.40	4.0	3.5	1.45	2.7	4.05	4.05	5.2
27	7.05	5.75	5.2	5.85	4.80	4.0	3.5	1.9	2.65	3.85	4.15	6.3
28	6.65	5.7	6.3	5.65	4.95	4.0	3.5	1.95	2.6	3.4	4.1	6.1
29	6.3	.....	6.45	4.85	5.15	4.0	2.8	2.1	2.6	3.85	3.45	5.2
30	6.25	.....	6.15	5.9	5.35	3.9	3.7	2.2	1.5	3.6	4.1	6.3
31	6.9	.....	5.8	.....	5.35	.....	3.8	2.2	.....	3.15	.....	5.6

NOTE.—The following ice conditions prevailed during 1906: River began to freeze over about the middle of January, one-fourth mile below gage being entirely closed; ice about 0.65 foot thick. Freezing began at the gage about February 1; February 28 ice all gone at gage; river still frozen over about one-fourth mile below. Ice went out of river about March 31. Needle ice forms at times and causes backwater. December 2, river began filling with needle ice below gage, causing a rise of nearly 4 feet. During the frozen period in December gage heights were taken to top of ice. The following comparative readings were also taken:

Date.	Water surface.	Top of ice.	Thickness of ice at gage.
	Feet.	*Feet.*	*Feet.*
December 15	7.5	7.4	[a] 0.65
December 19	6.5	6.7	[a] .83
December 22	6.8	6.9	.83
December 26	5.0	5.2	1.16
December 29	4.9	5.2	[b] 1.70

[a] Anchor ice. [b] Anchor ice gone.

Rating table for Raquette River at Massena Springs, N. Y., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	265	2.60	1,005	3.90	2,040	5.40	3,435
1.30	310	2.70	1,070	4.00	2,130	5.60	3,625
1.40	355	2.80	1,140	4.10	2,220	5.80	3,820
1.50	400	2.90	1,210	4.20	2,310	6.00	4,020
1.60	445	3.00	1,285	4.30	2,400	6.20	4,220
1.70	495	3.10	1,360	4.40	2,490	6.40	4,420
1.80	545	3.20	1,435	4.50	2,580	6.60	4,620
1.90	595	3.30	1,515	4.60	2,675	6.80	4,820
2.00	650	3.40	1,595	4.70	2,770	7.00	5,020
2.10	705	3.50	1,680	4.80	2,865	8.00	6,020
2.20	760	3.60	1,770	4.90	2,960	9.00	7,020
2.30	820	3.70	1,860	5.00	3,055	10.00	8,020
2.40	880	3.80	1,950	5.20	3,245	11.00	9,020
2.50	940						

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-1906, and is well defined below gage height 7 feet.

Monthly discharge of Raquette River at Massena Springs, N. Y., for 1906.

[Drainage area, 1,170 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	8,620	2,490	4,140	3.54	4.08
March	4,470	1,640	2,910	2.49	2.87
April	4,120	1,320	2,920	2.50	2.79
May	4,920	2,800	3,640	3.11	3.58
June	4,470	2,040	3,250	2.78	3.10
July	2,260	940	1,900	1.62	1.87
August	1,770	265	875	.748	.86
September	1,140	400	851	.727	.81
October	2,180	445	1,100	.940	1.08
November	2,260	700	1,600	1.37	1.53

NOTE.—Values are rated as follows: January and March, fair; April to November, excellent.

LAKE CHAMPLAIN DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Lake Champlain occupies a long and narrow valley, extending in a north-south direction, and forming a part of the boundary between New York and Vermont. The elevation of the lake is about 95 feet above tide, and the water-surface area is 436 square miles.

The drainage basin is irregular in form, being about 75 miles wide from a point opposite Middlebury, Vt., northward to the outlet of the lake at Rouse Point, on the international boundary. South of Middlebury the average width of the basin is about 35 miles and the lake itself is very narrow, forming virtually a drowned river. The drainage is received almost entirely through large tributaries, there being little direct coast drainage into the lake. The outlet of the lake is Richelieu River, which flows northward from Rouse Point to St. Lawrence River.

In estimating the run-off from this basin in previous years the drainage area has been taken as 7,500 square miles. The areas of the tributary basins are given in Water-Supply Paper No. 170, pages 97–98.

The land drainage area above Rouse Point is 7,463 square miles; hence the run-off as heretofore computed represents substantially the outflow expressed as depth in inches on the land surface. As the precipitation on the lake probably exceeds the evaporation, the water surface of the lake, 436 square miles, should be added to the land area and the run-off computed for the whole drainage basin, 7,899 square miles.

The daily discharge of the lake has been determined from observations of the depth and discharge over the Chambly dam, 35 miles below the head of Richelieu River, made in 1898 by the United States Board on Deep Waterways. A rating table has been derived from the observations at the Chambly dam and the gage readings taken at Rouse Point. The area tributary to the river between Rouse Point and Chambly is 310 square miles, making the total drainage basin above Chambly 8,209 square miles.

RICHELIEU RIVER AT FORT MONTGOMERY, N. Y.

A record of the height of Lake Champlain at Rouse Point, at the head of Richelieu River, the outlet of the lake, has been kept by the United States Corps of Engineers, beginning in 1875. Through the courtesy of Capt. Harry Taylor, the gage readings taken by William McComb, the fort keeper, at 9 a. m. each day are reported weekly to the United States Geological Survey. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 98, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Richelieu River at Fort Montgomery, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.05	3.55	3.0	3.1	4.7	4.3	3.5	2.5	1.5	1.1	0.7	1.5
2	2.2	3.4	3.05	3.15	4.75	4.25	3.65	2.5	1.6	1.15	.8	1.5
3	2.15	3.5	3.0	3.2	4.7	4.2	3.4	2.5	1.5	1.1	.9	1.5
4	2.3	3.7	3.0	3.2	4.75	4.1	3.45	2.55	1.45	1.1	.8	1.4
5	2.25	3.35	3.05	3.15	4.65	4.05	3.4	2.5	1.6	1.1	.75	1.4
6	2.3	3.3	3.15	3.2	4.6	4.1	3.4	2.45	1.75	1.35	.8	1.4
7	2.25	3.25	3.2	3.25	4.5	4.0	3.35	2.3	1.6	1.0	.7	1.45
8	2.2	3.3	3.1	3.3	4.5	4.15	3.3	2.25	1.5	1.05	.75	1.5
9	2.25	3.15	3.05	3.4	4.65	4.1	3.4	2.25	1.55	1.5	.7	1.5
10	2.3	3.2	3.05	3.4	4.5	4.15	3.25	2.4	1.5	.9	.75	1.5
11	2.25	3.2	3.05	3.45	4.4	4.05	3.2	2.6	1.55	.9	.8	1.5
12	2.2	3.15	3.0	3.5	4.7	4.1	3.2	2.4	1.65	.8	.7	1.5
13	2.1	3.05	3.05	3.55	4.65	4.05	3.3	2.3	1.8	1.0	.75	1.55
14	2.15	3.0	2.95	4.1	4.55	4.1	3.15	2.05	1.45	.9	.8	1.5
15	2.2	3.0	2.9	3.9	4.65	4.0	3.25	1.95	1.3	.9	.8	1.6
16	2.4	3.1	2.85	3.8	4.7	4.1	3.2	2.0	1.45	.75	.8	1.45
17	2.1	3.05	2.85	4.0	4.65	4.1	3.0	2.15	1.5	.85	.85	1.5
18	2.2	3.1	2.75	4.25	4.7	3.95	3.0	2.0	1.4	.8	1.05	1.4
19	2.1	3.0	2.8	4.3	4.55	3.85	3.05	2.0	1.3	1.0	.95	1.45
20	2.4	3.1	2.7	4.45	4.5	3.75	3.15	1.95	1.3	.75	1.1	1.45
21	2.25	3.15	2.8	4.6	4.4	3.75	3.0	1.9	1.2	.75	1.15	1.4
22	2.3	3.0	2.65	4.7	4.4	3.65	2.95	1.8	1.2	.8	1.2	1.5
23	2.45	3.05	2.55	4.75	4.4	3.6	2.8	1.7	1.15	.9	1.2	1.5
24	2.95	3.2	2.52	4.75	4.3	3.6	2.75	1.65	1.1	.9	1.2	1.5
25	3.2	3.1	2.5	4.85	4.35	3.65	2.6	1.9	1.2	.85	1.35	1.45
26	3.5	3.05	2.55	4.9	4.45	3.75	2.75	1.85	1.4	.9	1.4	1.45
27	3.6	3.05	2.7	4.8	4.35	3.7	2.7	1.8	1.05	1.15	1.3	1.5
28	3.5	3.0	2.55	4.85	4.25	3.6	2.6	1.6	1.1	1.2	1.45	1.55
29	3.55	.....	2.75	4.9	4.3	3.7	2.75	1.5	1.4	.9	1.4	1.6
30	3.7	.....	2.95	4.85	4.3	3.65	2.8	1.55	1.05	.85	1.6	1.6
31	3.5	.....	3.0	.....	4.4	.....	2.5	1.45	.....	.7	.....	1.65

NOTE.—The following ice conditions prevailed during 1906: December 6, 1905, to January 15, 1906, lake closed; ice from 0.5 to 1.0 foot thick. January 20 to February 2, lake open. February 3, lake frozen over, no ice in channel near gage; ice about 0.3 foot thick above gage near breakwater. February 14, ice 0.65 foot thick below gage and 0.35 foot thick above gage. March 15, channel open below gage; ice 0.35 foot thick above gage. March 31, ice all out below breakwater.

Rating table for Richelieu River at Fort Montgomery, N. Y., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.70	5,680	1.70	9,080	2.70	12,520	3.70	16,260
0.80	6,020	1.80	9,420	2.80	12,880	3.80	16,640
0.90	6,360	1.90	9,760	2.90	13,240	3.90	17,020
1.00	6,700	2.00	10,100	3.00	13,600	4.00	17,400
1.10	7,040	2.10	10,440	3.10	13,980	4.20	18,240
1.20	7,380	2.20	10,780	3.20	14,360	4.40	19,080
1.30	7,720	2.30	11,120	3.30	14,740	4.60	19,940
1.40	8,060	2.40	11,460	3.40	15,120	4.80	20,820
1.50	8,400	2.50	11,800	3.50	15,500	5.00	21,700
1.60	8,740	2.60	12,160	3.60	15,880		

NOTE.—The above table is based on discharge measurements made at Chambly dam in 1898 by the United States Board on Deep Waterways.

Monthly discharge of Richelieu River at Fort Montgomery, N. Y., for 1906.

[Drainage area, 7,750 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	16,300	10,300	12,000	1.55	1.79
February	16,300	13,600	14,300	1.85	1.93
March	14,400	11,800	13,200	1.70	1.96
April	21,300	14,000	17,500	2.26	2.52
May	20,600	18,700	19,600	2.53	2.92
June	18,700	15,900	17,200	2.22	2.48
July	16,100	11,800	14,000	1.81	2.09
August	12,200	8,230	10,400	1.34	1.54
September	9,420	6,870	8,070	1.04	1.16
October	8,400	5,680	6,580	.849	[illegible]
November	8,740	5,680	6,650	.858	[illegible]
December	8,910	8,060	8,370	1.08	[illegible]
The year	21,300	5,680	12,300	1.59	21.[illegible]

NOTE. Discharge not affected by ice conditions on the lake.

SARANAC RIVER NEAR PLATTSBURG, N. Y.

A gaging station was established at the dam of the Plattsburg Electric Light and Power Company, 6 miles above Plattsburg, March 17, 1903. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 102, where are given also references to publications that contain data for previous years.

Daily discharge, in second-feet, of Saranac River near Plattsburg, N. Y., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	763	994	551	1,100	512	966	1,020	610	381	181	722	[illegible]
2	660	828	595	946	775	1,050	1,140	501	72	312	581	[illegible]
3	603	742	524	723	488	708	964	477	162	337	550	[illegible]
4	718	538	1,100	980	889	1,060	950	509	310	412	206	[illegible]
5	770	528	1,300	1,100	1,130	688	994	585	385	330	222	[illegible]
6	796	513	977	1,160	1,350	749	958	831	373	242	363	[illegible]
7	751	496	781	961	1,120	893	806	520	447	80	390	313
8	547	554	654	842	877	739	800	599	338	336	537	[illegible]
9	582	539	613	782	882	1,020	1,160	484	106	617	384	[illegible]
10	518	624	689	811	785	861	1,000	390	491	471	394	[illegible]
11	518	714	546	799	754	1,040	1,210	319	447	434	70	411
12	a 408	760	416	663	769	980	835	a 338	305	417	479	[illegible]
13	299	671	510	738	1,350	1,020	513	356	335	478	346	[illegible]
14	554	660	532	1,130	2,120	898	445	399	426	136	307	[illegible]
15	403	554	502	1,880	2,090	863	278	539	291	400	286	[illegible]
16	717	539	363	1,710	1,820	844	316	476	52	417	408	[illegible]
17	572	562	321	1,550	1,520	762	333	438	224	491	487	[illegible]
18	496	605	329	1,790	1,600	945	506	330	395	437	109	[illegible]
19	469	678	376	1,500	1,260	795	202	a 489	419	382	843	[illegible]
20	497	479	348	1,270	1,100	609	314	648	381	364	564	[illegible]
21	748	940	374	1,340	984	704	421	296	404	42	898	[illegible]
22	1,770	1,510	318	1,060	930	1,000	a 425	365	415	246	755	[illegible]
23	2,260	1,130	372	1,110	694	1,160	430	276	128	398	870	[illegible]
24	2,940	1,050	368	1,040	928	587	580	338	185	476	742	[illegible]
25	2,370	1,200	419	731	1,280	647	493	339	411	597	321	454
26	1,820	1,610	534	576	1,250	376	514	a 332	372	680	848	[illegible]
27	1,700	1,030	878	740	1,250	613	638	a 332	265	628	648	[illegible]
28	1,880	602	1,640	710	1,080	502	656	324	309	328	784	[illegible]
29	1,450	.....	1,450	674	1,110	482	170	338	287	557	906	[illegible]
30	1,150	.....	1,450	614	1,020	540	514	309	210	556	465	[illegible]
31	1,010	.....	1,530	.....	1,000	.....	544	325	.....	637	.....	[illegible]

a Discharge interpolated.

NOTE. During January, February, March, and December the dam is slightly obstructed by ice, and discharges are liable to error.

Monthly discharge of Saranac River near Plattsburg, N. Y., for 1906.

[Drainage area, 624 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	2,940	299	991	1.59	1.83
February	1,610	513	776	1.24	1.29
March	1,640	318	687	1.10	1.27
April	1,790	576	1,030	1.65	1.84
May	2,090	488	1,120	1.79	2.06
June	1,160	376	803	1.29	1.44
July	1,210	170	649	1.04	1.20
August	831	276	436	.699	.81
September	491	52	311	.498	.57
October	680	42	401	.643	.74
November	906	70	516	.827	.92
December	809	156	431	.601	.80
The year	2,940	42	679	1.09	14.76

NOTE.—Values are rated as follows: January to March and December, good; April to November, excellent.

OTTER CREEK AT MIDDLEBURY, VT.

This station was established April 1, 1903, by H. K. Barrows. It is located at the railway bridge about one-half mile south of the railway station at Middlebury, Vt. The conditions at this station and the bench marks are described in Water-Supply Paper No. 170, page 106, where are given also references to publications that contain data for previous years.

Discharge measurements of Otter Creek at Middlebury, Vt., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
March 29 [a]	Butterfield and Brett	120	597	15.65	3,760
April 1 [a]	A. D. Butterfield	120	711	16.72	4,900
April 4 [a]	do	120	768	17.22	5,500
April 10 [a]	do	120	581	15.52	3,750
April 10 [b]	do	189	1,520	15.50	3,430
May 1 [a]	Butterfield and Brett	120	367	13.40	1,370
May 12 [a]	G. M. Brett	118	334	12.90	946
1906.					
March 10 [c]	H. K. Barrows	106	352	13.40	1,160
April 14	G. M. Brett	133	465	14.25	2,100
September 26	A. D. Butterfield	117	229	12.35	316
November 8	do	117	229	12.27	344

[a] From arch bridge.
[b] From railroad bridge.
[c] River frozen at gage, but open 500 feet below gage for some 800 feet to arch bridge and dam. Gage height to bottom of ice, 12.77 feet; average thickness of ice, 0.70 foot.

Daily gage height, in feet, of Otter Creek at Middlebury, Vt., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		13.4		15.6	14.0	15.45	13.95	13.2	12.6	12.2	12.6	12.85
2		13.2	13.2	15.5	13.75	15.5	14.2	12.8	12.45	12.8	12.6	12.8
3				15.15	14.0	15.55	13.8	12.6	12.35	12.3	12.5	12.55
4				14.75	14.45	15.3	13.4	12.5	12.7	12.3	12.5	
5				14.45	14.5	14.9	13.6	12.65	12.6	12.2	12.35	
6	13.4			14.6	14.4	14.25	13.4	12.9	12.5	12.15	12.4	
7		13.2		14.5	14.1	13.9	13.1	13.15	12.4	12.1	12.4	
8				14.2	13.8	14.1	12.85	13.0	12.4	12.0	12.35	
9				13.9	13.5	14.5	12.7	12.75	12.4	12.1	12.3	
10			13.45	13.7	14.15	14.5	12.8	12.55	12.1	12.2	12.3	

Daily gage height, in feet, of Otter Creek at Middlebury, Vt., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11				13.7	14.4	14.45	13.0	12.5	12.25	12.2	12.3	
12				13.9	14.35	14.2	12.85	12.6	12.3	12.35	12.3	
13	12.8	12.5		13.95	14.3	13.7	12.7	12.5	12.3	12.4	12.6	12.35
14				14.25	14.5	13.2	12.6	12.5	12.4	12.6	12.6	
15				15.3	14.55	12.95	12.5	12.4	12.4	12.1	12.55	
16			12.4	15.5	14.3	12.9	12.4	12.4	12.3	12.3	12.5	
17				15.5	14.05	13.0	12.4	12.4	12.0	12.3	12.4	
18				15.7	13.8	13.7	12.45	12.4	12.15	12.25	12.45	
19				15.95	13.6	13.7	12.4	12.25	12.3	12.15	13.6	12.5
20	12.8			16.3	13.25	13.3	12.4	12.0	12.3	12.05	14.3	
21		12.4		16.4	13.1	13.0	12.4	12.5	12.2	13.0	14.2	
22			12.3	16.45	12.95	12.9	12.4	12.5	12.2	13.0	13.85	
23				16.35	12.8	12.85	12.9	12.45	12.3	12.85	13.6	
24	15.5			16.25	12.8	13.2	12.9	12.5	12.2	12.5	13.3	
25	15.25			16.15	12.85	13.5	12.7	12.5	12.3	12.5	13.15	
26	15.25			15.9	13.1	13.4	12.5	12.6	12.35	12.7	12.9	12.3
27	15.55			15.65	13.5	13.1	12.4	13.05	12.3	12.9	13.25	
28	15.25		14.7	15.3	14.6	12.85	12.4	14.7	12.2	12.75	13.5	
29	14.7			14.9	14.9	12.7	12.7	13.6	12.2	12.6	13.45	
30	14.4			14.5	15.1	12.9	13.4	13.2	12.3	12.6	13.1	
31	13.7		15.7		15.3		13.6	12.8		12.6		

NOTE.—Creek was frozen January 1 to 24, February 3 to March 31, and December 3 to 31. During the frozen period gage heights were taken to water surface through a hole in the ice. The following comparative readings were taken:

Comparative ice and water readings.

Date.	Water surface.	Top of ice.	Thickness of ice.	Date.	Water surface.	Top of ice.	Thickness of ice.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*	*Feet.*
January 6	13.4	13.45	0.3	March 10	13.45	13.5	0.6
January 13	12.8	12.9	.6	March 16	12.4	12.45	.5
January 20	12.8	12.9	.5	March 22	12.3	12.4	.6
February 7	13.2	13.3	.5	March 28 [a]	14.7		
February 13	12.5	12.3	.5	December 13	12.35	12.35	.5
February 21	12.4	12.5	.9	December 19	12.5	12.6	.6
March 2	13.2	13.3	.7	December 26	12.3	12.45	.7

[a] Water flowing on top of ice.

Rating table for Otter Creek at Middlebury, Vt., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
12.00	220	13.10	1,030	14.20	2,080	15.60	3,610
12.10	275	13.20	1,120	14.30	2,180	15.80	3,830
12.20	335	13.30	1,210	14.40	2,290	16.00	4,070
12.30	400	13.40	1,300	14.50	2,400	16.20	4,310
12.40	470	13.50	1,390	14.60	2,510	16.40	4,550
12.50	540	13.60	1,480	14.70	2,620	16.60	4,790
12.60	615	13.70	1,580	14.80	2,730	16.80	5,030
12.70	695	13.80	1,680	14.90	2,840	17.00	5,270
12.80	775	13.90	1,780	15.00	2,950	17.20	5,510
12.90	860	14.00	1,880	15.20	3,170	17.40	5,750
13.00	945	14.10	1,980	15.40	3,390		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905–6, and is well defined between gage heights 13.0 feet and 18.0 feet. Mean monthly discharge computed from the above should be reasonably close, but daily discharges for gage heights below 13.0 feet are liable to considerable error. Fluctuations caused by the dam below render variable the relation between gage height and the elevation of the water surface at the measuring section.

Monthly discharge of Otter Creek at Middlebury, Vt., for 1905–6.

[Drainage area, 615 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
April	5,630	1,210	2,950	4.80	5.36
May	1,300	400	871	1.42	1.64
June	2,400	335	1,210	1.97	2.20
July	2,620	220	904	1.47	1.70
August	2,730	305	951	1.55	1.79
September	2,890	655	1,570	2.55	2.84
October	860	400	590	.960	1.11
November	1,430	400	625	1.02	1.14
December	2,130	600	969	1.58	1.82
1906.					
April	4,610	1,580	3,130	5.09	5.68
May	3,280	775	1,870	3.04	3.50
June	3,560	695	1,710	2.78	3.10
July	2,080	470	881	1.43	1.65
August	2,620	220	738	1.20	1.38
September	695	220	421	.685	.76
October	945	220	498	.810	.93
November	2,180	400	869	1.41	1.57

NOTE.—Values are rated as follows: October to December, 1905, September and October, 1906, fair; all others, good.

WINOOSKI RIVER AT RICHMOND, VT.

This station was established June 25, 1903, by H. K. Barrows, at the steel highway bridge one-fourth mile south of the railway station at Richmond, Vt. The conditions [a] at this station and the bench marks are described in Water-Supply Paper No. 170, page 108, where are given also references to publications that contain data for previous years.

Discharge measurements of Winooski River at Richmond, Vt., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 9 [b]	H. K. Barrows	70	348	5.53	585
March 29	A. D. Butterfield	182	1,590	6.96	3,190
April 13	do	182	1,470	6.57	3,500
April 18	Butterfield and Nye	183	1,960	9.55	9,180
April 25	A. D. Butterfield	180	1,430	6.50	3,380
April 25	G. M. Brett	180	1,430	6.50	3,210
May 23	Butterfield and Brett	180	1,130	4.97	1,240
May 23	do	180	1,130	4.97	1,290
September 25	A. D. Butterfield	145	180	3.92	389
November 30	do	178	1,110	5.10	1,350

[a] Length of chain, 29.47 feet. Gage datum is at elevation 287.63 feet above mean sea level, as determined during 1906 by connecting with the aluminum tablet bench mark of United States Geological Survey in Universalist church foundation.

[b] River frozen at gage; channel open 1,000 feet upstream and one-half mile downstream. Ice very rough, broken, and tilted, reaching to bottom for about two-thirds of section. Gage height is to water surface; gage height to bottom of ice about 3.4 feet; average thickness of ice about 2.8 feet.

Daily gage height, in feet, of Winooski River at Richmond, Vt., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.4	.....	5.7	6.6	5.4	5.45	5.05	4.05	4.25	4.5	5.15
2	.....	5.45	5.9	5.4	6.15	5.25	5.1	4.45	3.85	4.05	4.4	5.5
3	.....	6.3	.....	5.3	6.9	5.3	4.75	4.25	5.55	4.1	4.3	5.4
4	.....	6.3	.....	5.5	6.7	5.1	4.9	4.15	6.25	3.8	4.3	6.5
5	5.95	6.3	.....	6.5	6.45	4.85	5.2	4.1	5.0	3.8	4.35	6.2
6	.....	5.9	.....	7.35	6.15	5.1	4.8	4.25	4.6	3.9	4.3	6.1
7	.....	6.25	.....	6.3	5.8	6.55	4.45	5.75	4.4	4.1	4.25	6.0
8	.....	5.9	.....	6.35	5.5	5.9	4.35	4.7	4.05	3.8	4.1	.....
9	.....	5.8	5.5	6.1	5.75	6.1	4.3	4.25	3.95	4.15	4.0	.....
10	.....	.....	.....	5.9	7.3	5.6	4.3	4.15	4.15	4.25	4.2	.....
11	.....	.....	.....	5.6	6.5	5.5	5.35	4.15	4.1	4.25	4.0	.....
12	5.5	.....	.....	6.6	6.05	5.2	4.85	3.75	3.85	4.75	4.6	.....
13	.....	.....	.....	6.7	10.2	4.95	4.5	3.85	3.85	4.7	4.6	.....
14	.....	.....	.....	7.8	8.4	4.8	4.3	3.95	3.95	4.6	4.4	5.9
15	.....	.....	.....	11.7	6.8	4.5	4.05	4.0	3.95	4.5	4.3	.....
16	.....	5.55	5.3	11.4	6.35	4.5	4.25	3.85	3.75	4.7	4.8	.....
17	.....	.....	.....	9.8	6.1	4.5	3.95	3.85	3.7	4.45	4.9	.....
18	.....	.....	.....	9.25	6.1	5.45	3.95	3.75	3.85	4.2	5.3	.....
19	5.4	.....	.....	9.15	5.75	5.05	4.3	3.55	4.15	4.15	7.95	.....
20	.....	.....	.....	9.35	5.35	4.7	4.05	3.45	3.85	5.5	6.55	.....
21	.....	.....	.....	9.5	5.15	4.5	4.65	3.95	3.85	5.7	5.8	5.7
22	.....	.....	.....	9.9	5.25	4.7	5.15	3.75	3.85	5.0	5.7	.....
23	11.2	8.55	5.4	8.1	4.95	5.35	4.55	3.75	3.75	4.7	5.8	.....
24	13.8	.....	.....	7.0	4.85	7.7	4.25	4.0	3.95	4.55	5.3	.....
25	7.75	.....	.....	6.4	5.85	6.4	4.05	3.95	3.95	4.8	4.9	.....
26	6.7	.....	.....	6.3	6.5	5.7	4.0	3.65	3.95	5.3	4.95	.....
27	6.35	.....	.....	6.1	7.25	5.2	4.15	4.15	4.15	4.9	5.7	.....
28	6.2	.....	7.6	6.05	8.15	4.8	3.95	7.9	4.0	4.6	6.15	5.7
29	5.6	.....	6.9	5.9	6.7	5.1	3.9	5.05	4.2	4.7	5.7	.....
30	5.5	.....	6.45	6.4	6.1	5.35	6.65	4.55	4.65	4.5	5.15	.....
31	5.5	.....	6.3	.....	5.65	.....	6.05	4.35	.....	4.4	.....	.....

NOTE. River frozen January 1 to 22, February 7 to March 28, and December 4 to 31. During the frozen period gage heights were taken to water surface through a hole in the ice. The following comparative readings were taken:

Comparative ice and water readings.

Date.	Water surface.	Top of ice.	Thickness of ice.	Date.	Water surface.	Top of ice.	Thickness of ice.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*	*Feet*
January 5[a]	5.95	5.7	1.1	December 7	6.0	6.15	0.8
January 12	5.5	5.65	1.3	December 14	5.9	6.1	1.4
January 19	5.4	5.55	1.4	December 21	5.7	5.95	1.5
March 9[b]	5.5	6.2	2.8	December 28	5.7	5.9	1.5

[a] Water on top of ice.

[b] During the period from about January 23 to March 28 gage heights give little or no indication of discharge owing to an ice jam at the bridge. See note to measurement made March 9, 1906.

Rating table for Winooski River at Richmond, Vt., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.40	215	4.80	1,060	6.20	2,830	8.20	6,350
3.50	235	4.90	1,165	6.30	2,980	8.40	6,750
3.60	260	5.00	1,275	6.40	3,140	8.60	7,160
3.70	290	5.10	1,385	6.50	3,300	8.80	7,580
3.80	330	5.20	1,500	6.60	3,460	9.00	8,000
3.90	380	5.30	1,615	6.70	3,620	9.20	8,420
4.00	435	5.40	1,735	6.80	3,790	9.40	8,840
4.10	495	5.50	1,860	6.90	3,960	9.60	9,270
4.20	560	5.60	1,985	7.00	4,130	9.80	9,710
4.30	630	5.70	2,115	7.20	4,470	10.00	10,150
4.40	705	5.80	2,250	7.40	4,830	11.00	12,400
4.50	785	5.90	2,390	7.60	5,190	12.00	14,700
4.60	870	6.00	2,530	7.80	5,570		
4.70	960	6.10	2,680	8.00	5,950		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1906 and the form of previous curves. It is well defined between gage heights 3.9 feet and 10.0 feet. An increase in discharge for a given gage height is taking place at this station from year to year. These yearly changes may be due to the scouring effect of ice jams.

Monthly discharge of Winooski River at Richmond, Vt., for 1906.

[Drainage area, 885 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April	14,000	1,620	5,000	5.65	6.30
May	10,600	1,110	3,230	3.65	4.21
June	5,380	785	1,700	1.92	2.14
July	3,540	380	964	1.09	1.26
August	5,760	225	753	.851	.98
September	2,900	290	615	.695	.78
October	2,120	330	831	.939	1.08
November	5,860	435	1,390	1.57	1.75

NOTE.—Values are rated as follows: April to June, good; July to November, fair.

INDEX.

A. Page.

Acknowledgments..... 16
Acre-foot, definition of..... 4
Albion, Mich.,
Reed's springs near:
description..... 30
gage heights..... 30
Allegan, Mich.,
Kalamazoo River near:
description..... 28
discharge, daily..... 28
discharge, monthly..... 28
Alloway, N. Y.,
Canandaigua Outlet at:
description..... 63-64
gage heights..... 64
Au Sable River at—
Bamfield, Mich.:
description..... 36
discharge, monthly..... 37
gage heights..... 36-37
rating table..... 37

B.

Baldwinsville, N. Y.,
Seneca River at:
description..... 66
discharge, daily..... 67
discharge, monthly..... 67
Bamfield, Mich.,
Au Sable River near:
description..... 36
discharge, monthly..... 37
gage heights..... 36-37
rating table..... 37
Barrows, H. K., work in charge of..... 1
Battle Island, N. Y.,
Oswego River at:
description..... 62-63
discharge, monthly..... 63
gage heights..... 63
rating table..... 63
Black River (of Lake Erie) near—
Elyria:
description..... 50
discharge..... 50
discharge, monthly..... 52
gage heights..... 51
rating table..... 52
Black River (of Lake Ontario) near
Felts Mills, N. Y.:
description..... 75
discharge, daily..... 75-76
discharge, monthly..... 76
Black River (of Lake Ontario) basin: Page.
description..... 75
Bolster, R. H., work of..... 1
Brennan, M. S., work of..... 1
Buchanan, Mich.,
St. Joseph River near:
description..... 27
discharge, daily..... 27-28
discharge, monthly..... 27

C.

Cable station, figure showing..... 11
Canadice Lake outlet near—
Hemlock, N. Y.:
description..... 60
discharge, monthly..... 61
Canandaigua Outlet at—
Alloway, N. Y.:
description..... 63-64
gage heights..... 64
Cayuga Lake at—
Ithaca, N. Y.:
description..... 66
gage heights..... 66
Champlain, Lake, drainage basin:
description..... 84
Chittenango Creek at—
Chittenango, N. Y.:
description..... 71
discharge..... 71
discharge, monthly..... 72
gage heights..... 71
rating table..... 72
Computation, methods of..... 13-16
Cooperation, acknowledgments for..... 16
Covert, C. C., work of..... 1
Crivitz, Wis.,
Peshtigo River at:
description..... 20-21
discharge..... 21
gage heights..... 21
Peshtigo River near:
description..... 21-22
discharge..... 22
discharge, monthly..... 22
gage heights..... 22
rating table..... 22
Current meters, classes of..... 10
methods of using..... 10-11
plate showing..... 10
Current meter station, view of..... 10
Curves (discharge, area, and velocity), figure showing..... 15

Page.
Cuyahoga River at—
Independence, Ohio:
description..... 53
discharge..... 53
gage heights..... 53–54
Cuyahoga River basin:
description..... 53

D.

Defiance, Ohio,
Tiffin River near:
description..... 49
discharge..... 49
discharge, monthly..... 50
gage heights..... 49
rating table..... 50
Definitions of terms used..... 3–4
Dexter, Mich.,
Huron River at:
description..... 41
gage heights..... 41–42
Discharge, methods of measuring and computing..... 13–16
Drainage basins, list of..... 2–3
map showing..... 2
Dugan, D. H., work of..... 1

E.

East Rush, N. Y.,
Honeoye Creek at:
description..... 61
discharge, daily..... 61
discharge, monthly..... 62
Elyria, Ohio,
Black River (of Lake Erie) near:
description..... 50
discharge..... 50
discharge, monthly..... 52
gage heights..... 51
rating table..... 52
Equivalents, table of..... 6–7
Erie, Lake, drainage:
general features..... 40
station data..... 41–54
Escanaba River near—
Escanaba, Mich.:
description..... 17
discharge..... 17
discharge, monthly..... 18
gage heights..... 17
rating table..... 18
Euclid, N. Y.,
Oneida River near:
description..... 69
discharge..... 69
discharge, daily..... 69
discharge, monthly..... 70

F.

Felts Mills, N. Y.,
Black River near:
description..... 75
discharge, daily..... 75–76
discharge, monthly..... 76
Flatrock, Mich.,
Huron River at:
description..... 42–43
discharge..... 43
discharge, monthly..... 44
gage heights..... 43
rating table..... 43

Page.
Floats, use of, in measuring discharge..... 9–10
Follansbee, Robert, work of..... 1
Fort Montgomery, N. Y.,
Richelieu River at:
description..... 84
discharge, monthly..... 85
gage heights..... 85
rating table..... 85
Fort Wayne, Ind.,
St. Joseph (of the Maumee) River at:
description..... 46
discharge..... 46
discharge, monthly..... 47
gage heights..... 46
rating table..... 46
St. Marys River at:
description..... 47
discharge..... 47
discharge, monthly..... 49
gage heights..... 48
rating table..... 48
Freeland, Mich.,
Tittabawassee River at:
description..... 39
discharge..... 39
gage heights..... 39–40

G.

Gaging stations, equipment of..... 9–10
location of, map showing..... 2
Geddes, Mich.,
Huron River at:
description..... 42
discharge, monthly..... 42
Genesee River at or near—
High dam near Mount Morris, N. Y.:
description..... 57–58
Mount Morris, N. Y.:
description..... 56
discharge..... 56
discharge, monthly..... 57
gage heights..... 56
rating table..... 57
Rochester, N. Y.:
description..... 58
discharge..... 58
discharge, monthly..... 60
gage heights..... 58
rating table..... 59
Genesee River basin:
description..... 54–55
Geneva, N. Y.,
Seneca Lake at:
description..... 64–65
gage heights..... 65
Gillett, Wis.,
Oconto River at:
description..... 23
discharge..... 23
gage heights..... 23–24
Grand River at—
Grand Rapids, Mich.:
description..... 32
discharge..... 32
gage heights..... 32–33

Page.

Grand River at—
North Lansing, Mich.:
description 30
discharge 31
discharge, monthly 32
gage heights 31
rating table 31
Grand River basin, Mich.:
description 30

H.

Hemlock, N. Y.,
Canadice Lake outlet near:
description 60
discharge, monthly 61
Henshaw, F. F., work of 1
Honeoye Creek at—
East Rush, N. Y.:
description 61
discharge, daily 61
discharge, monthly 62
Horsepower, calculation of 5
Horton, A. H., work in charge of 1
Horton, R. E., work of 1
Hoyt, J. C., work of 1
Huron, Lake, drainage:
general features 36
station data 36–40
Huron River at—
Dexter, Mich.:
description 41
gage heights 41–42
Flatrock, Mich.:
description 42–43
discharge 43
discharge, monthly 44
gage heights 43
rating table 43
Geddes, Mich.:
description 42
discharge, monthly 42
Huron River basin:
description 41
Hydrographic surveys, organization and scope of 2

I.

Ice-covered streams, method of measuring flow of 13
Independence, Ohio,
Cuyahoga River at:
description 53
discharge 53
gage heights 53–54
Iron Mountain, Mich.,
Menominee River near:
description 18
discharge 18
discharge, monthly 20
gage heights 19
rating table 19
Ithaca, N. Y.,
Cayuga Lake at:
description 66
gage heights 66

K.

Page.

Kalamazoo River near—
Allegan, Mich.:
description 28
discharge, daily 28
discharge, monthly 28
Kalamazoo River basin:
description 28
Kenwood, N. Y.,
Oneida Creek at:
description 70
gage heights 70

L.

Lakes. *See particular names.*

M.

Manistee River near—
Sherman, Mich.:
description 35
discharge 35
gage heights 35
Manistee River basin:
description 35
Massena Springs, N. Y.
Raquette River at:
description 82
discharge 82
discharge, monthly 83
gage heights 82–83
rating table 83
Maumee River near—
Sherwood, Ohio:
description 44
discharge 44
discharge, monthly 45
gage heights 44–45
rating table 45
Maumee River basin:
description 44
Mendon, Mich.,
St. Joseph River near:
description 27
discharge 27
Menominee River near—
Iron Mountain, Mich.:
description 18
discharge 18
discharge, monthly 20
gage heights 19
rating table 19
Michigan, Lake, drainage:
general features 16–17
station data 17–35
Middlebury, Vt.,
Otter Creek at:
description 87
discharge 87
discharge, monthly 89
gage heights 87–88
rating table 88
Miner's inch, definition of 4
Moose River at—
Moose River, N. Y.:
description 76
discharge 76

Page.
Moose River at—
Moose River N. Y.—Continued.
discharge, monthly..... 77
gage heights..... 77
rating table..... 77
Mount Morris, N. Y.,
Genesee River at high dam near:
description..... 57-58
Genesee River near:
description..... 56
discharge..... 56
discharge, monthly..... 57
gage heights..... 56
rating table..... 57
Multiple-point method of measuring discharge, description of..... 11-12
Muskegon River at—
Newaygo, Mich.:
description..... 34
discharge, daily..... 34
discharge, monthly..... 34
Muskegon River basin:
description..... 33

N.

Newaygo, Mich.,
Muskegon River at:
description..... 34
discharge, daily..... 34
discharge, monthly..... 34
North Lansing, Mich.,
Grand River at:
description..... 30
discharge..... 31
discharge, monthly..... 32
gage heights..... 31
rating table..... 31

O.

Oconto River at—
Gillett, Wis.:
description..... 23
discharge..... 23
gage heights..... 23-24
Stiles, Wis.:
description..... 24
discharge..... 24
gage heights..... 24
Oconto River basin:
description..... 23
Ogdensburg, N. Y.,
Oswegatchie River near:
description..... 79
discharge..... 79
discharge, monthly..... 80-81
gage heights..... 78
rating table..... 80
Oneida Creek at—
Kenwood, N. Y.:
description..... 70
gage heights..... 70
Oneida River near—
Euclid, N. Y.:
description..... 69
discharge..... 69
discharge, daily..... 69
discharge, monthly..... 70
Ontario, Lake, drainage: Page.
general features..... 54
station data..... 54-75
Oswegatchie River near—
Ogdensburg, N. Y.:
description..... 79
discharge..... 79
discharge, monthly..... 80-81
gage heights..... 79
rating table..... 80
Oswegatchie River basin:
description..... 78-79
Oswego River at—
Battle Island, N. Y.:
description..... 62-63
discharge, monthly..... 63
gage heights..... 63
rating table..... 63
Oswego River basin:
description..... 62
Otter Creek at—
Middlebury, Vt.:
description..... 87
discharge..... 87
discharge, monthly..... 89
gage heights..... 87-88
rating table..... 88

P.

Padgett, H. D., work of..... 1
Peshtigo River at—
Crivitz, Wis.:
description..... 20-21
discharge..... 21
gage heights..... 21
Herman's farm, near Crivitz, Wis.:
description..... 21-22
discharge..... 22
discharge, monthly..... 22
gage heights..... 22
rating table..... 22
Peshtigo River basin:
description..... 20
Plattsburg, N. Y.,
Saranac River near:
description..... 86
discharge, daily..... 86
discharge, monthly..... 87
Price current meter, views of..... 15
Pulaski, N. Y.,
Salmon River near:
description..... 73
discharge..... 73
discharge, monthly..... 74
gage heights..... 73-74
rating table..... 74

R.

Raquette River at—
Massena Springs, N. Y.:
description..... 82
discharge..... 82
discharge, monthly..... 83
gage heights..... 82-83
rating table..... 83
Raquette River basin:
description..... 81-82
Rating tables, construction of..... 13-15

Page.
Reed's springs near—
Albion, Mich.:
description..... 30
gage heights and discharge..... 30
Reineking, V. H., work of..... 1
Richelieu River at—
Fort Montgomery, N. Y.:
description..... 84
discharge, monthly..... 85
gage heights..... 85
rating table..... 85
Richmond, Vt.,
Winooski River at:
description..... 89
discharge..... 89
discharge, monthly..... 91
gage heights..... 90
rating table..... 91
Rifle River near—
Sterling, Mich.:
description..... 38
discharge..... 38
gage heights..... 38-39
Rifle River basin:
description..... 38
Rochester, N. Y.,
Genesee River at:
description..... 58
discharge..... 58
discharge, monthly..... 60
gage heights..... 58
rating table..... 59
Run-off, computation of..... 13-16
Run-off in inches, definition of..... 4

S.

Saginaw River basin:
description..... 39
St. Joseph [of the Maumee] River at—
Fort Wayne, Ind.:
description..... 46
discharge..... 46
discharge, monthly..... 47
gage heights..... 46
rating table..... 47
St. Joseph River near—
Buchanan, Mich.:
description..... 27
discharge, daily..... 27-28
discharge, monthly..... 28
Mendon, Mich.:
description..... 27
discharge..... 27
St. Joseph River basin:
description..... 26-27
St. Lawrence River drainage:
general features..... 78
station data..... 78-91
St. Marys River at—
Fort Wayne, Ind.:
description..... 47
discharge..... 47
discharge, monthly..... 49
gage heights..... 48
rating table..... 48

Page.
Salmon River near—
Pulaski, N. Y.:
description..... 73
discharge..... 73
discharge, monthly..... 74
gage heights..... 73-74
rating table..... 74
Salmon River basin:
description..... 72-73
Saranac River near—
Plattsburg, N. Y.:
description..... 86
discharge, daily..... 86
discharge, monthly..... 86
Second-feet per square mile, definition of... 4
Second-foot, definition of..... 4
Seneca Lake at—
Geneva, N. Y.:
description..... 64-65
gage heights..... 65
Seneca River at—
Baldwinsville, N. Y.:
description..... 66
discharge, daily..... 67
discharge, monthly..... 67
Shawano, Wis.,
Wolf River at Darrow's bridge near:
description..... 25
discharge..... 25
gage heights..... 25
Wolf River at White House bridge near:
description..... 25
discharge..... 26
gage heights..... 26
Sherman, Mich.,
Manistee River near:
description..... 35
discharge..... 35
gage heights..... 35
Sherwood, Ohio,
Maumee River near:
description..... 44
discharge..... 44
discharge, monthly..... 45
gage heights..... 44-45
rating table..... 44
Single-point method of measuring discharge, description of..... 12
Skaneateles Lake outlet at—
Willow Glen, N. Y.:
description..... 67
discharge, daily..... 68
discharge, monthly..... 68
Slope method of measuring discharge, description of..... 7-8
Smith, L. S., work of..... 1
Sterling, Mich.,
Rifle River near:
description..... 38
discharge..... 38
gage heights..... 38-39
Stewart, J. E., work of..... 1

Stiles, Wis., Page.
Oconto River at:
description 24
discharge 24
gage heights 24
Stream flow, measurement and computation of 7-13
papers on, list of 3
Surface water supply, papers on, list of 2-3

T.

Tables, explanation of 4-6
Tiffin River near—
Defiance, Ohio:
description 49
discharge 49
discharge, monthly 50
gage heights 49
rating table 50
Tittabawassee River at—
Freeland, Mich.:
description 39
discharge 39
gage heights 39-40

V.

Velocity methods of measuring discharge, description of 9-13
Vertical-integration method of measuring discharge, description of 12

W. Page.
Water power, calculation of 5
Water supply, surface, papers on, list of 2-3
Weir method of measuring discharge, description of 8-9
Willow Glen, N. Y.,
Skaneateles Lake outlet at:
description 67
discharge, daily 68
discharge, monthly 68
Winooski River at—
Richmond, Vt.:
description 89
discharge 88
discharge, monthly 90
gage heights 90
rating table 91
Wolf River at—
Darrow's bridge near Shawano, Wis.:
description 25
discharge 25
gage heights 25
White House bridge near Shawano, Wis.:
description 25
discharge 26
gage heights 26
Wolf River basin:
description 24-25

CLASSIFICATION OF THE PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

[Water-Supply Paper No. 206.]

The publications of the United States Geological Survey consist of (1) Annual Reports, (2) Monographs, (3) Professional Papers, (4) Bulletins, (5) Mineral Resources, (6) Water-Supply and Irrigation Papers, (7) Topographic Atlas of United States—folios and separate sheets thereof, (8) Geologic Atlas of United States—folios thereof. The classes numbered 2, 7, and 8 are sold at cost of publication; the others are distributed free. A circular giving complete lists can be had on application.

Most of the above publications can be obtained or consulted in the following ways:

1. A limited number are delivered to the Director of the Survey, from whom they can be obtained, free of charge (except classes 2, 7, and 8), on application.

2. A certain number are delivered to Senators and Representatives in Congress, for distribution.

3. Other copies are deposited with the Superintendent of Documents, Washington, D. C., from whom they can be had at practically cost.

4. Copies of all Government publications are furnished to the principal public libraries in the large cities throughout the United States, where they can be consulted by those interested.

The Professional Papers, Bulletins, and Water-Supply Papers treat of a variety of subjects, and the total number issued is large. They have therefore been classified into the following series: A, Economic geology; B, Descriptive geology; C, Systematic geology and paleontology; D, Petrography and mineralogy; E, Chemistry and physics; F, Geography; G, Miscellaneous; H, Forestry; I, Irrigation; J, Water storage; K, Pumping water; L, Quality of water; M, General hydrographic investigations; N, Water power; O, Underground waters; P, hydrographic progress reports.

Series P.—The hydrographic progress reports contain the results of stream measurements. A report is issued for every calendar year, containing the results of data collected during that year. These reports were first published as a part of the Director's annual report or as a bulletin; they are now published as water-supply and irrigation papers. The following is a list, by years, of the publications containing the progress reports of stream measurements (* means out of stock). A detailed index of these reports (1888-1903) is published as Water-Supply Paper No. 119.

1888. Tenth Annual Report, Part II*.
1889. Eleventh Annual Report, Part II*.
1890. Twelfth Annual Report, Part II*.
1891. Thirteenth Annual Report, Part III*.
1892. Fourteenth Annual Report, Part II*.
1893. Bulletin No. 131*.
1894. Bulletin No. 131*; Sixteenth Annual Report, Part II*.
1895. Bulletin No. 140*.
1896. Water-Supply Paper No. 11*; Eighteenth Annual Report, Part IV*.
1897. Water-Supply Papers Nos. 15* and 16*; Nineteenth Annual Report, Part IV*.
1898. Water-Supply Papers Nos. 27* and 28*; Twentieth Annual Report, Part IV*.
1899. Water-Supply Papers Nos. 35*, 36*, 37*, 38*, and 39*; Twenty-first Annual Report, Part IV*.
1900. Water-Supply Papers Nos. 47, 48, 49, 50, 51, and 52; Twenty-second Annual Report, Part IV.

1901. East of Mississippi River, Water-Supply Papers Nos. 65* and 75*.
West of Mississippi River, Water-Supply Papers Nos. 66 and 75*.
1902. East of Mississippi River, Water-Supply Papers Nos. 82 and 83.
West of Mississippi River, Water-Supply Papers Nos. 84 and 85.
1903. East of Mississippi River, Water-Supply Papers Nos. 97 and 98.
West of Mississippi River, Water-Supply Papers Nos. 99 and 100.
1904. East of Mississippi River, Water-Supply Papers Nos. 124, 125, 126, 127, 128, and 129.
West of Mississippi River, Water-Supply Papers Nos. 130, 131, 132, 133, 134, and 135.
1905. East of Mississippi River, Water-Supply Papers Nos. 165*, 166*, 167, 168*, 169, 170, and 171.
West of Mississippi River, Water-Supply Papers Nos. 171, 172*, 173*, 174, 175*, 176, 177, and 178.
1906. East of Mississippi River, Water-Supply Papers Nos. 201, 202, 203, 204, 205, 206, and 207.
West of Mississippi River, Water-Supply Papers Nos. 207, 208, 209, 210, 211, 212, 213, and 214.

Correspondence should be addressed to

THE DIRECTOR,
UNITED STATES GEOLOGICAL SURVEY,
WASHINGTON, D. C.

JULY, 1907.

O

Water-Supply and Irrigation Paper No. 207 Series P, Hydrographic Progress Reports, 61

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

SURFACE WATER SUPPLY
OF
UPPER MISSISSIPPI RIVER AND HUDSON BAY DRAINAGES

1906

A. H. HORTON AND ROBERT FOLLANSBEE
DISTRICT HYDROGRAPHERS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1907

CONTENTS.

	Page.
Introduction	1
Scope of work	1
Definitions	3
Explanation and use of tables	4
Convenient equivalents	6
Field methods of measuring stream flow	7
Office methods of computing run-off	13
Cooperation and acknowledgments	16
Hudson Bay drainage	16
General features	16
St. Mary River drainage basin	16
Description of basin	16
St. Mary River near Babb, Mont	17
St. Mary River near Cardston, Alberta	19
Swiftcurrent Creek near Babb, Mont	20
Kennedy Creek near Babb, Mont	22
Red River drainage basin	22
Description of basin	22
Red River at Fargo, N. Dak	23
Red River at Grand Forks, N. Dak	25
Ottertail River near Fergus Falls, Minn	26
Sheyenne River near Haggart, N. Dak	28
Red Lake River at Crookston, Minn	30
Pembina River near Neche, N. Dak	32
Miscellaneous measurements	34
Mouse River drainage basin	34
Description of basin	34
Mouse River near Foxholm, N. Dak	35
Mouse River at Minot, N. Dak	35
Des Lacs River at Foxholm, N. Dak	38
Upper Mississippi River drainage	39
General features	39
Main Mississippi River	41
Mississippi River near Sauk Rapids, Minn	41
Mississippi River at Anoka, Minn	43
Miscellaneous measurements	43
Crow River drainage basin	45
Description of basin	45
Crow River near Dayton, Minn	45
Rum River drainage basin	46
Description of basin	46
Rum River near Anoka, Minn	47

Upper Mississippi River drainage—Continued. Page.
Minnesota River drainage basin 49
Description of basin 49
Minnesota River near Mankato, Minn 49
Chippewa River drainage basin 50
Description of basin 50
Chippewa River at Chippewa Falls, Wis 51
Chippewa River near Eau Claire, Wis 52
Flambeau River near Ladysmith, Wis 54
Flambeau River survey 56
Black River drainage basin 56
Description of basin 56
Black River survey 57
Black River at Neillsville, Wis 57
Wisconsin River drainage basin 59
Description of basin 59
Wisconsin River survey 60
Eau Claire River survey 60
Wisconsin River near Rhinelander, Wis 60
Wisconsin River at Merrill, Wis 62
Wisconsin River near Necedah, Wis 63
Wapsipinicon River drainage basin 65
Description of basin 65
Wapsipinicon River at Stone City, Iowa 65
Rock River drainage basin 67
Description of basin 67
Rock River at Rockton, Ill 67
Rock River near Nelson, Ill 69
Rock River at Sterling, Ill 70
Iowa River drainage basin 71
Description of basin 71
Iowa River at Iowa City 71
Cedar River at Cedar Rapids, Iowa 72
Red Cedar River at Janesville, Iowa 74
Des Moines River drainage basin 76
Description of basin 76
Des Moines River at Fort Dodge, Iowa 76
Des Moines River at Des Moines, Iowa 77
Des Moines River at Keosauqua, Iowa 79
Illinois River drainage basin 80
Description of basin 80
Illinois River near Peoria, Ill 81
Desplaines River near Channahon, Ill 82
Kankakee River at Davis, Ind 83
Kankakee River at Momence, Ill 85
Yellow River at Knox, Ind 86
Fox River at Sheridan, Ill 87
Index 89

ILLUSTRATIONS.

		Page.
PLATE I.	Map of United States, showing location of principal river stations maintained during 1906	2
II.	*A*, Current-meter rating station at Los Angeles, Cal.; *B*, Price current meters	10
III.	*A*, Brunett Falls, Chippewa River; *B*, Lower pitch of Big Falls, Flambeau River	50
IV.	*A*, Grandfather Rapids, Wisconsin River; *B*, Evaporation station, Madison, Wis	60
FIG. 1.	Cable station, showing section of river, car, gage, etc	11
2.	Typical discharge, area, and mean-velocity curves	15

SURFACE WATER SUPPLY OF UPPER MISSISSIPPI AND HUDSON BAY DRAINAGES, 1906.[a]

A. H. HORTON and ROBERT FOLLANSBEE,
District Hydrographers.

INTRODUCTION.

SCOPE OF WORK.

The water supply of the United States is of more importance to the life and pursuits of the people than is any other natural resource. In the arid States the limit of agricultural development is determined by the amount of water available for irrigation; while in all parts of the country the increase in the population of cities and towns makes necessary additional water supplies for domestic and industrial uses, in procuring which both the quantity and the quality of the water that may be obtained must be considered. The location of manufacturing plants may depend largely on the water-power facilities and on the character of the water. The notable advances made in the electric transmission of power have led to the utilization of water powers for the operation of manufacturing establishments, railroads, and municipal lighting plants, many of which are at some distance from the places at which the power is developed.

The intelligent establishment and maintenance of enterprises or industries that depend on the use of water demands a thorough knowledge of the flow of the streams and an understanding of the conditions affecting that flow. This knowledge should be based on data showing both the total flow and the distribution of the flow throughout the year, in order that normal fluctuations may be provided for. As the flow of a stream is variable from year to year, estimates of future flow can be made only from a study of observations covering several years. The rapid increase in the development of the water resources of the United States has caused a great demand by engineers for information in regard to the flow of streams, as it is now

[a] This report contains information similar to that published in previous years under the title "Report of Progress of Stream Measurements."

generally realized that the failure of many large power, irrigatio other projects has been due to the fact that the plans were without sufficient trustworthy information in respect to the supply.

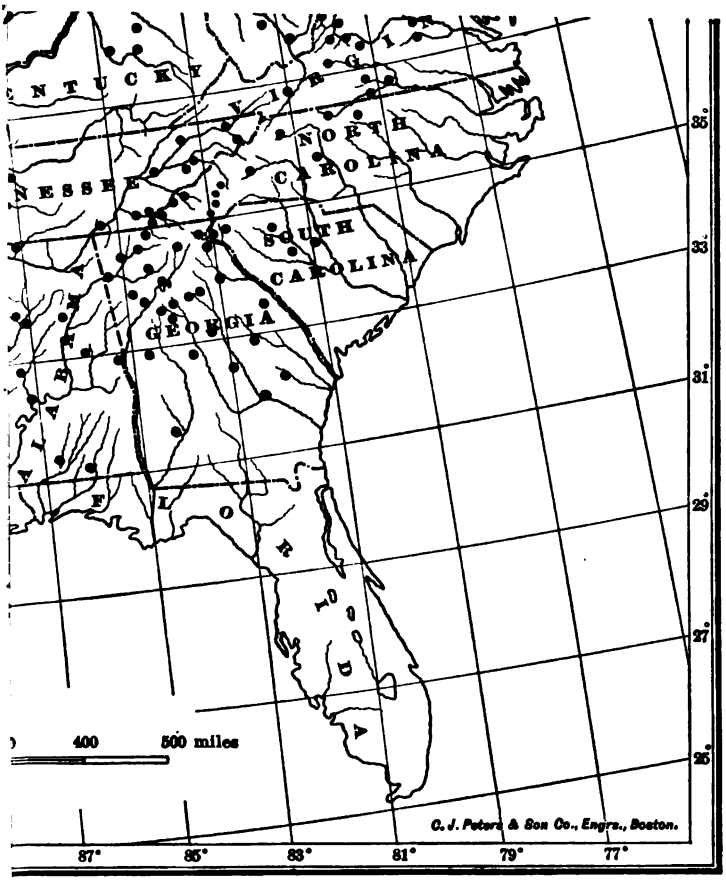
Owing to the broad scope of these hydrographic investigatio the length of time they should cover in order that the records m of greatest value, it is in general impossible for private individu collect the necessary data, and as many of the streams traverse than one State this work does not properly fall within the pr of the State authorities. The United States Geological Surv therefore, by means of specific appropriations by Congress, for s years systematically made records of stream flow, with the v ultimately determining all the important features governing th of the principal streams of the country. In carrying out thi stations are established on the streams and maintained for a long enough to show their regimen or general behavior. W record that is sufficient for this purpose has been obtained fo stream the work on that stream is discontinued. The order in the streams are measured is determined by the degree of their i tance.

During 1906 the regimen of flow was studied at about 700 st distributed along the various rivers throughout the United Stat shown on Pl. I. In addition to these records data in regard to cipitation, evaporation, water power, and river profiles were obt in many sections of the country.

These data have been assembled by drainage areas, and are lished in a series of fourteen Water-Supply and Irrigation P Nos. 201 to 214, inclusive, each of which pertains to the surface resources of a group of adjacent areas. In these papers are embo not only the data collected in the field, but also the results of com tations based on these data, and other information that has a di bearing on the subject, such as descriptions of basins and the strea draining them, utility of the water resources, etc. The list follo

Water-Supply and Irrigation Papers on Surface Water Supply, 1906.

201. Surface water supply of New England, 1906. (Atlantic Coast of New Engl drainage.)
202. Surface water supply of the Hudson, Passaic, Raritan, and Delaware river dra ages, 1906.
203. Surface water supply of the Middle Atlantic States, 1906. (Susquehanna, Gu powder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages.)
204. Surface water supply of the Southern Atlantic and Eastern Gulf States, 190 (Santee, Savannah, Ogeechee, and Altamaha rivers and eastern Gulf of Mexic drainages.)
205. Surface water supply of the Ohio and lower eastern Mississippi river drainage 1906.


NORTH
CAROLINA
SOUTH
CAROLINA
GEORGIA
FLORIDA
400
500 miles
35°
33°
31°
29°
27°
25°
87°
85°
83°
81°
79°
77°
C. J. Peters & Son Co., Engrs., Boston.

DURING 1906.

206. Surface water supply of the Great Lakes and St. Lawrence River drainages, 1906.
207. Surface water supply of the upper Mississippi River and Hudson Bay drainage, 1906.
208. Surface water supply of the Missouri River drainage, 1906.
209. Surface water supply of the lower western Mississippi River drainage, 1906.
210. Surface water supply of the western Gulf of Mexico and Rio Grande drainages, 1906.
211. Surface water supply of the Colorado River drainage above Yuma, 1906.
212. Surface water supply of the Great Basin drainage, 1906.
213. Surface water supply of California, 1906. (The Great Basin and Pacific Ocean drainage in California, and Colorado River drainage below Yuma.)
214. Surface water supply of the North Pacific Coast drainages, 1906.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing such records up to and including 1903 has been published in Water-Supply Paper No. 119. The following table gives, by years and primary drainage basins, the numbers of the papers on the surface water supply, published from 1901 to 1906.

Numbers of water-supply papers containing results of stream measurements, 1901–1906.[a]

	1901.	1902.	1903.	1904.	1905.	1906.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
Atlantic Coast of New England drainage	65 75	82	97	124	165	201
Hudson, Passaic, Raritan, and Delaware river drainages	65 75	82	97	125	166	202
Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages	65 75	82 83	97 98	126	167	203
Santee, Savannah, Ogeechee, and Altamaha river and eastern Gulf of Mexico drainages	65 75	83	98	126	168	204
Ohio and lower eastern Mississippi river drainages	65 75	83	98	128	169	205
Great Lakes and St. Lawrence River drainages	65	83	97	129	170	206
Hudson Bay and upper eastern and western Mississippi River drainages	65 66 75	83 84 85	98 99 100	128 130	171	207
Missouri River drainage	66 75	84	99	130 131	172	208
Meramec, Arkansas, Red, and lower western Mississippi river drainages	66 75	84	99	131	173	209
Western Gulf of Mexico and Rio Grande drainages	66 75	84	99	132	174	210
Colorado River drainage above Yuma	66 75	85	100	133	175	211
The Great Basin drainage	66 75	85	100	133	176	212
The Great Basin and Pacific Ocean drainages in California, and Colorado River drainage below Yuma	66 75	85	100	134	177	213
North Pacific Coast drainages	66 75	85	100	135	178	214

DEFINITIONS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups—(1) those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet

[a] Reports containing data for years prior to 1901 are noted in the series list at the end of this paper.

per square mile, and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the quantity of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the quantity of water that passes through an orifice 1 inch square under a head which varies locally. It has been commonly used by miners and irrigators throughout the West and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

"Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work. There is a convenient relation between the second-foot and the acre-foot: One second-foot flowing for twenty-four hours will deliver 86,400 cubic feet, or approximately 2 acre-feet.

EXPLANATION AND USE OF TABLES.

For each regular gaging station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of monthly and yearly discharges and run-off.
6. Tables showing discharge and horsepower and the number of days during the year when the same are available.

The descriptions of stations give such general information about the locality and equipment as would enable the reader to find and use the station, and they also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge-measurement table gives the results of the discharge

measurements made during the year, including the date, the name of the hydrographer, the width and area of cross section, the gage height, and the discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage heights taken each day. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. At most stations the gage is read in the morning and in the evening.

The discharge measurements and gage heights are the base data from which the other tables are computed. In cases of extensive development, it is expected that engineers will use these original data in making their calculations, as the computations made by the Survey are based on the data available at the time they are made and should be reviewed and, if necessary, revised when additional data are available.

The rating table gives the discharge in second-feet, corresponding to various stages of the river, as given by the gage heights. It is published to enable engineers to determine the daily discharge in case this information is desired.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise, in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow for each second during the month. Upon this the computations for the remaining columns, which are defined on page 4, are based.

The values in the table of monthly discharge are intended to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates.

In most work where data in regard to flow are used the regimen of flow is of primary importance. Therefore for the principal stations tables have been prepared showing the horsepower that can be developed at various rates of flow and the length of time that these rates of flow and the corresponding horsepower are available. These tables have been prepared on a basis of 80 per cent efficiency on the turbines, and the horsepower per foot of fall is given in order that the reader can determine the horsepower for any fall.

In the computations sufficient significant figures have been used so that the percentage of error in the tables will not in general exceed 1 per cent. Therefore most of the values in the tables are given to

only three significant figures. In making the various computations Thatcher's slide rule, Crelle's tables, and computation machines have been generally used.

In order to give engineers an idea of the relative value of the various data, notes in regard to accuracy are given as far as possible. This accuracy depends on the general local conditions at the gaging stations and the amount of data collected. Every effort possible is made to so locate the stations that the data collected will give a high degree of accuracy. This is not always possible, but it is considered better to publish rough values with explanatory notes rather than no data.

In the accuracy notes the following terms have been used, indicating the probable accuracy in per cent of the mean monthly flow. As these values are mean values, the error in the value for the flow of any individual day may be much larger.

Excellent indicates that the mean monthly flow is probably accurate to within 5 per cent; good, to within 10 per cent; fair, to within 15 per cent; approximate, to within 25 per cent.

CONVENIENT EQUIVALENTS.

Following is a table of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot quals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second-foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equal 15.7 United States gallons per second.
100 California miner's inches equal 96.0 Colorado miner's inches.
100 California miner's inches for one day equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 104 California miner's inches.
100 Colorado miner's inches for one day equal 5.17 acre-feet.

100 United States gallons per minute equal 0.223 second-foot.
100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1⅓ horsepower equal about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel, realizing 80 per cent of theoretical power.

FIELD METHODS OF MEASURING STREAM FLOW.

The methods used in collecting these data and in preparing them for publication are given in detail in Water-Supply Papers No. 94 (Hydrographic Manual, U. S. Geological Survey) and No. 95 (Accuracy of Stream Measurements). In order that those who use this report may readily become acquainted with the general methods employed, the following brief descriptions are given:

Streams may be divided, with respect to their physical conditions, into three classes—(1) those with permanent beds; (2) those with beds which change only during extreme low or high water; (3) those with constantly shifting beds. In determining the daily flow special methods are necessary for each class. The data upon which these determinations are based and the methods of collecting them are, however, in general the same.

There are three distinct methods of determining the flow of open-channel streams—(1) by measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir; (3) by measurements of the velocity of the current and the area of the cross section. The method chosen for any case depends upon the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to the coefficients to be used in the Chezy formula, $v = c\sqrt{Rs}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The results obtained by the slope method are, in general, only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for n to be used in Kutter's formula. The most common use of this method is in determining the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions.

Weir methods.—When funds are available and the conditions are such that sharp-crested weirs can be erected, these offer the best facilities for determining the flow. If dams are suitably situated and constructed, they may be utilized for obtaining reliable measurements of flow. The conditions necessary to insure good results may be divided into two classes—(1) those relating to the physical characteristics of the dam itself and (2) those relating to the diversion and use of water around and through the dam.

The physical requirements are as follows: (*a*) Sufficient height of dam, so that backwater will not interfere with free fall over it; (*b*) absence of leaks of appreciable magnitude; (*c*) topography or abutments which confine the flow over the dam at high stages; (*d*) level crests, which are kept free from obstructions caused by floating logs or ice; (*e*) crests of a type for which the coefficients to be used in $Q = c\,b\,h^{\frac{3}{2}}$, or some similar standard weir formula are known (see Water-Supply Papers Nos. 180 and 200[a]); (*f*) either no flash boards or exceptional care in reducing leakage through them and in recording their condition.

Preferably there should be no diversion of water through or around the dam. Generally, however, the dam is built for purposes of power or navigation and part or all of the water flowing past it is diverted for such uses. This water is measured and added to that passing over the dam. To insure accuracy in such determinations of flow the amount of water diverted should be reasonably constant. Furthermore, it should be so diverted that it can be measured, either by a weir, a current meter, or a simple system of water wheels which are of standard make, or which have been rated as meters under working conditions, and so installed that the gate openings, the heads under which they work, and their angular velocities may be accurately observed.

The combination of physical conditions and uses of the water should be such that the determinations of flow will not involve, for a critical stage of considerable duration, the use of a head, on a broad-

[a] Water-Supply Paper No. 200 replaces No. 150, the edition of which has been exhausted.

crested dam, of less than 6 inches. Moreover, when all other conditions are good, the cooperation of the owners or operators of the plant is still essential if reliable results are to be obtained.

A gaging station at a weir or dam has the general advantage of continuity of record through the period of ice and floods and the disadvantages of uncertainty of coefficient to be used in the weir formula and of complications in the diversion and use of the water.

Velocity method.—The determination of the quantity of water flowing past a certain section of a stream at a given time is termed a discharge measurement. This quantity is the product of two factors—the mean velocity and the area of the cross section. The mean velocity is a function of surface slope, wetted perimeter, roughness of bed, and the channel conditions at, above, and below the gaging section. The area depends upon the contour of the bed and the fluctuations of the water surface. The two principal ways of measuring the velocity of a stream are by floats and current meters.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements in order that the data may have the required degree of accuracy. Their essential requirements are practically the same whether the velocity is determined by meters or floats. They are located as far as possible where the channel is straight both above and below the gaging section; where there are no cross currents, backwater, or boils; where the bed of the stream is reasonably free from large projections of a permanent character; and where the banks are high and subject to overflow only at flood stages. The station must be so far removed from the effects of tributary streams and of dams or other artificial obstructions that the gage height shall be an index of the discharge.

Certain permanent or semipermanent structures usually referred to as equipment are generally pertinent to a gaging station. These are a gage for determining the fluctuations of the water surface, bench marks to which the datum of the gage is referred, permanent marks on a bridge or a tagged line indicating the points of measurement, and, where the current is swift, some appliance (generally a secondary cable) to hold the meter in position in the water. As a rule, the stations are located at bridges if the channel conditions are satisfactory, as from them the observations can more readily be made and the cost of the equipment is small.

The floats in common use are the surface, subsurface, and tube or rod floats. A corked bottle with a flag in the top and weighted at the bottom makes one of the most satisfactory surface floats, as it is affected but little by wind. In case of flood measurements, good results can be obtained by observing the velocity of floating cakes of ice or débris. In case of all surface-float measurements, coefficients must be used to reduce the observed velocity to the mean velocity.

The subsurface and tube or rod floats are intended to give directly the mean velocity in the vertical. Tubes give excellent results when the channel conditions are good, as in canals.

In measuring velocity by a float, observation is made of the time taken by the float to pass over the "run," a selected stretch of river from 50 to 200 feet long. In each discharge measurement a large number of velocity determinations are made at different points across the stream, and from these observations the mean velocity for the whole section is determined. This may be done by plotting the mean positions of the floats as indicated by the distances from the bank as ordinates and the corresponding times as abscissas. A curve through these points shows the mean time of run at any point across the stream, and the mean time for the whole stream is obtained by dividing the area bounded by this curve and its axis by the width. The length of the run divided by the mean time gives the mean velocity.

The area used in float measurements is the mean of the areas at the two ends of the run and at several intermediate sections.

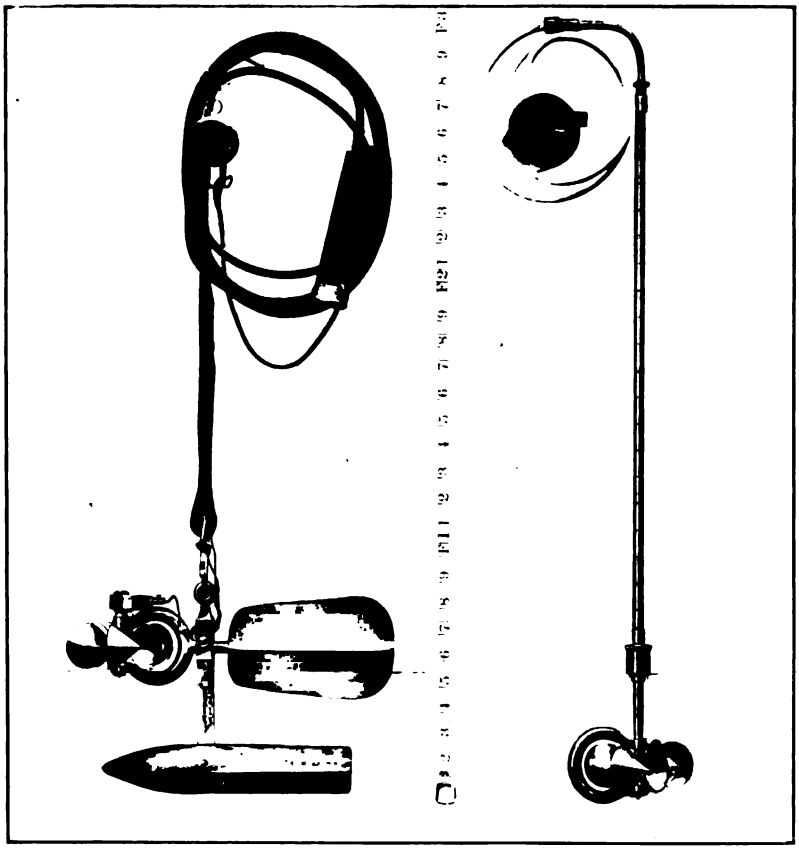
The essential parts of the current meters in use are a wheel of some type, so constructed that the impact of flowing water causes it to revolve, and a device for recording or indicating the number of revolutions. The relation between the velocity of the moving water and the revolutions of the wheel is determined for each meter. This rating is done by drawing the meter through still water for a given distance at different speeds and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity per second for any number of revolutions.

Many kinds of current meters have been constructed. They may, however, be classed in two general types: Those in which the wheel is made up of a series of cups, as the Price, and those having a screw propeller wheel, as the Haskell. Each meter has been developed for use under some special condition. In the case of the small Price meter, shown in Pl. II, *B*, which has been largely developed and has been extensively used by the United States Geological Survey, an attempt has been made to get an instrument which could be used under practically all conditions.

Current-meter measurements may be made from a bridge, a cable, a boat, or by wading, and gaging stations may be classified in accordance with such use. Fig. 1 shows a typical cable station.

In making the measurement an arbitrary number of points are laid off on a line perpendicular to the thread of the stream. The points at which the velocity and depth are observed are known as measuring points, and are usually fixed at regular intervals, varying from 2 to 20 feet, depending upon the size and condition of the stream. Perpendiculars dropped from the measuring points divide the gaging section into strips. For each strip or pair of strips the mean velocity,

A. CURRENT-METER RATING STATION AT LOS ANGELES, CAL.



B. PRICE CURRENT METERS.

area, and discharge are determined independently, so that conditions existing in one part of the stream may not be extended to parts where they do not apply.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

The three principal multiple-point methods in general use are the vertical velocity-curve; 0.2 and 0.8 depth; and top, bottom, and mid-depth.

In the vertical velocity-curve method a series of velocity determinations are made in each vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve among the resulting points, the vertical velocity-curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity-curve and its axis by the depth. On account of the length

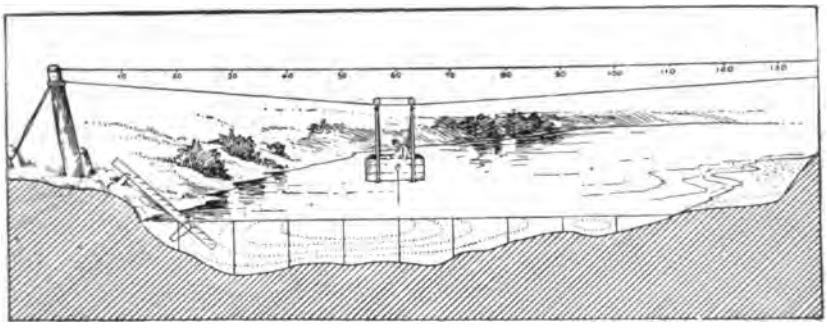


FIG. 1.—Cable station, showing section of river, car, gage, etc.

of time required to make a complete measurement by this method, its use is limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 of the depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity-curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 of the depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this second multiple-point method gives the mean velocity very closely for open-water conditions and, moreover, the indications are that it holds nearly as well for ice-covered rivers.

In the third multiple-point method the meter is held at mid-depth, at 0.5 foot below the surface, and at 0.5 foot above the bottom, and the mean velocity is determined by dividing by 6 the sum of the top

velocity, four times the mid-depth velocity, and the bottom velocity. This method may be modified by observing at 0.2, 0.6, and 0.8 depth.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined.

Extensive experiments by vertical velocity-curves show that the thread of mean velocity generally occurs at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, at which point the meter is held in a majority of the measurements. A large number of vertical velocity-curve measurements taken on many streams and under varying conditions show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be from 0.85 to 0.95, depending upon the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is especially adapted for flood measurements, or when the velocity is so great that the meter can not be kept at 0.6 depth.

The vertical-integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface, and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods.

The area, which is the other factor in the velocity method of determining the discharge of a stream, depends on the stage of the river, which is observed on the gage, and on the general contour of the bed of the stream, which is determined by soundings. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable or by a special sounding line or rod. For streams with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also of value in obtaining the area for use in computations of high-water measurements, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at various points of measurement, the measuring section is divided into elementary strips, as shown in fig. 1, and the

mean velocity, area, and discharge are determined separately for either a single or a double strip. The total discharge and the area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period, and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8, and vertical velocity-curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, the thickness and character of the ice, etc. From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice. For information in regard to flow under ice cover, see Water-Supply Paper No. 187.

OFFICE METHODS OF COMPUTING RUN-OFF.

There are two principal methods of determining run-off, depending upon whether or not the bed of the stream is permanent.

For stations on streams with permanent beds, the first step in computing the run-off is the construction of a rating table, which shows the discharge corresponding to any stage of the stream. This rating table is applied to the record of stage to determine the amount of water flowing. The construction of the rating table depends upon the method used in measuring flow.

For a station at a weir or dam, the basis for the rating table is some standard weir formula. The coefficients to be used in its application depend upon the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and assumed coefficient, the discharge is computed for various heads and the rating table constructed.

The data necessary for the construction of a rating table for a velocity-area station are the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross section, the mean velocity of the current, and the quantity of water flowing. A thorough knowledge of the conditions at and in the vicinity of the station is also necessary.

The construction of the rating table depends upon the following laws of flow for open, permanent channels: (1) The discharge will remain constant so long as conditions at or near the gaging station remain constant; (2) the discharge will be the same whenever the stream is at a given stage if the change of slope due to the rise and fall

of the stream be neglected; (3) the discharge is a function of and increases gradually with the stage.

The plotting of results of the various discharge measurements, using gage heights as ordinates, and discharge, mean velocity, and area as abscissas, will define curves which show the discharge, mean velocity, and area corresponding to any gage height. For the development of these curves there should be therefore a sufficient number of discharge measurements to cover the range of the stage of the stream. Fig. 2 shows a typical rating curve with its corresponding mean-velocity and area curves.

As the discharge is the product of two factors—the area and the mean velocity—any change in either factor will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is always concave toward the horizontal axis or on a straight line, unless the banks of the stream are overhanging.

The form of the mean-velocity curve depends chiefly upon the surface slope, the roughness of the bed, and the cross section of the stream. Of these the slope is the principal factor. In accordance with the relative changes of these factors the curve may be either a straight line, convex or concave toward either axis, or a combination of the three. From a careful study of the conditions at any gaging station the form which the vertical velocity-curve will take can be predicted, and it may be extended with reasonable certainty to stages beyond the limits of actual measurements. Its principal use is in connection with the area curve in locating errors in discharge measurements and in constructing the rating table.

The discharge curve is defined primarily by the measurements of discharge, which are studied and weighted in accordance with the local conditions existing at the time of each measurement. The curve may, however, best be located between and beyond the measurements by means of curves of area and mean velocity. The discharge curve under normal conditions is concave toward the horizontal axis and is generally parabolic in form.

In the preparation of the rating table the discharge for each tenth or half tenth on the gage is taken from the curve. The differences between successive discharges are then taken and adjusted according to the law that they shall either be constant or increasing.

The determination of daily discharge of streams with changeable beds is a difficult problem. In case there is a weir or dam available, a condition which seldom exists on streams of this class, the discharge can be determined by its use. In case of velocity-area stations frequent discharge measurements must be made if the deter-

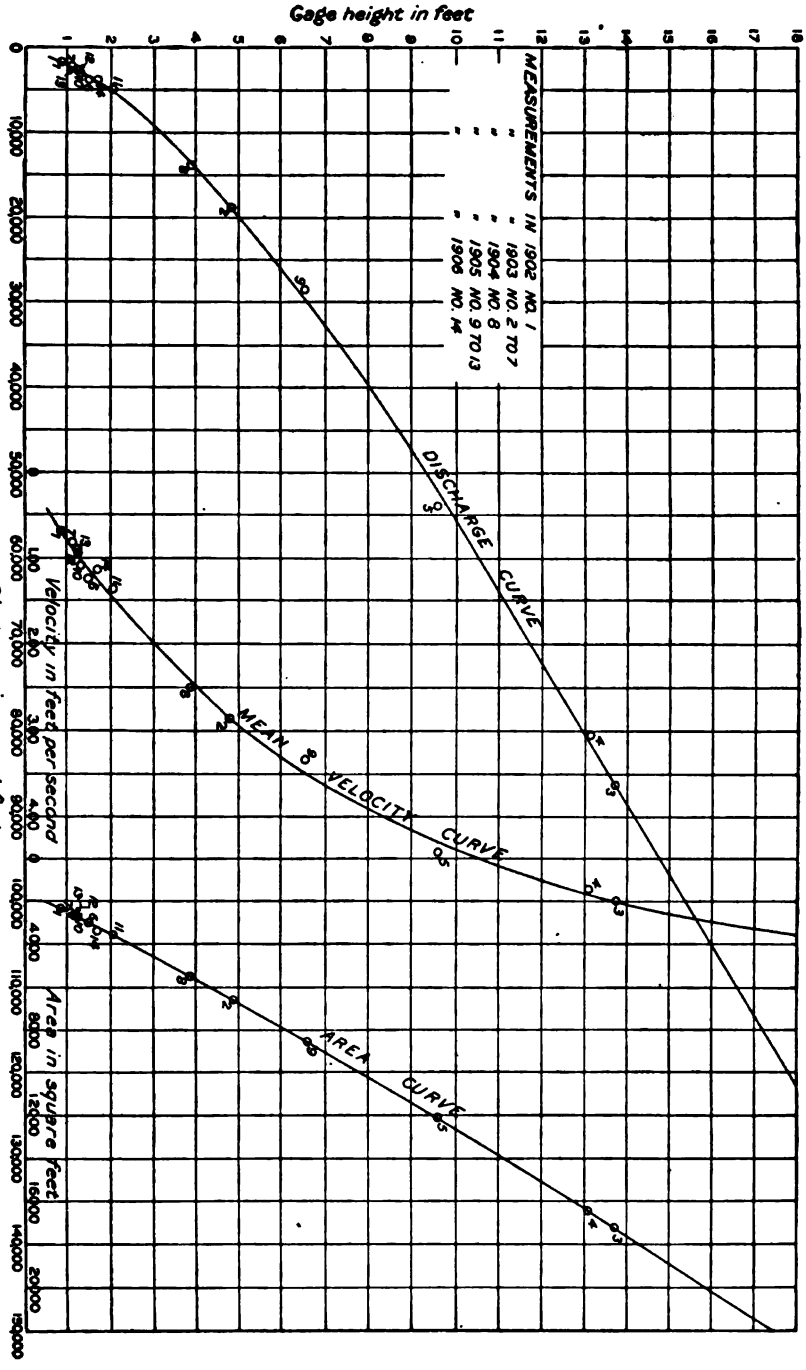


Fig. 2.—Discharge, area, and mean-velocity curves of Potomac River at Point of Rocks, Md.

minations of flow are to be other than rough approximations. For stations with beds which shift slowly or are materially changed only during floods, rating tables can be prepared for periods between such changes and satisfactory results obtained with a limited number of measurements, provided that some of them are taken soon after the change occurs. For streams with continually shifting beds, such as the Colorado and Rio Grande, discharge measurements should be made every two or three days and the discharge for intervening days obtained either by interpolation modified by gage height or by Professor Stout's method, which has been described in full in the Nineteenth Annual Report of the United States Geological Survey, Part IV, page 323, and in the Engineering News of April 21, 1904. This method, or a graphical application of it, is also much used in determining the flow at stations where the bed shifts but slowly.

COOPERATION AND ACKNOWLEDGMENTS.

Assistance has been rendered and records furnished by the following, to whom special acknowledgment is due: D. W. Mead, Madison, Wis.; officers and observers of the U. S. Weather Bureau; the Wisconsin Geological and Natural History Survey, E. A. Birge, director and superintendent.

HUDSON BAY DRAINAGE.

GENERAL FEATURES.

All the waters that reach Hudson Bay from the United States pass through Lake Winnipeg and thence into the bay through Nelson River. The two principal tributaries of Lake Winnipeg, and thus, indirectly, of Nelson River, are the Saskatchewan and Red River. The Saskatchewan drains the major portions of the provinces of Alberta and Saskatchewan and the northwestern part of Assiniboia, in the Dominion of Canada, and, through St. Mary River, a small area in northwestern Montana in the United States. Red River drains a large basin in the United States, covering portions of Minnesota and North and South Dakota. Both rivers are large and important.

ST. MARY RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

St. Mary River heads in northern Montana, near the Canadian boundary line, on the eastern slope of the main range of the Rocky Mountains, in a region of perpetual snow and in the midst of numerous glaciers. It starts from the great Blackfoot glacier, probably the largest in the Rocky Mountains within the United States, and receives affluents from at least a dozen lesser glaciers. These small streams

unite within a short distance from their sources and flow into a lake hemmed in by high mountains, known as Upper St. Mary Lake. Below this lake, separated from it by a narrow strip of land, is Lower St. Mary Lake, the aggregate length of the two lakes being about 22 miles. The river flows out of the lower lake, the elevation of which is 4,460 feet above sea level, and within 2 miles is joined by a stream nearly if not quite as large as itself, known as Swiftcurrent Creek, which is fed by the waters of Grinnell Glacier and four smaller glaciers. From the confluence of these streams to the international boundary, a distance of 12 miles, the St. Mary flows in a northerly direction, receiving Kennedy Creek a few miles before crossing the boundary. Entering the province of Alberta it empties into Belly River, its waters eventually finding their way through the Saskatchewan into Hudson Bay.

A canal has been constructed in Canada by the Canadian Northwest Irrigation Company to divert water from the right bank of St. Mary River, about 5 miles below the international boundary line.

The data collected in the basin are valuable for irrigation purposes.

ST. MARY RIVER NEAR BABB, MONT.[a]

This station was established April 9, 1902. It is located at Henry Henkel's ranch, about 1 mile east of his house and 35 miles northwest of Browning, Mont. It is also about 4,500 feet below the foot of Lower St. Mary Lake. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 17, where are given also references to publications that contain data for previous years.

Discharge measurements of St. Mary River near Babb, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 31	Freeman and Edson	50	50	1.40	66
May 11	W. I. Freeman	92	172	2.92	[a] 631
August 18	Morse and Hartman	90	161	2.82	629
September 14	Richards and Hartman	88	132	2.42	420

[a] Meter probably not in good order, causing results to be too low.

Daily gage height, in feet, of St. Mary River near Babb, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.9	1.9	1.4	1.5	2.8	3.3	3.7	3.0	2.8	2.2	3.0	2.7
2	1.9	1.9	1.4	1.5	2.8	3.3	3.7	3.0	2.8	2.1	3.1	2.6
3	1.9	1.9	1.4	1.5	2.9	3.5	3.7	2.9	2.8	2.2	3.1	2.6
4	1.9	1.9	1.4	1.5	2.9	3.6	3.7	2.9	2.8	2.1	3.1	2.5
5	1.9	1.9	1.4	1.6	2.9	3.7	3.8	2.9	2.7	2.2	3.0	2.5
6	1.9	1.9	1.5	1.6	2.9	3.8	3.8	2.9	2.7	2.1	2.9	2.4
7	1.9	1.9	1.5	1.6	2.9	3.8	3.9	2.8	2.7	2.2	2.8	2.4
8	1.9	1.9	1.5	1.6	2.9	3.9	3.9	2.8	2.7	2.1	2.9	2.4
9	1.9	1.9	1.5	1.6	2.9	3.9	4.0	2.8	2.7	2.3	2.7	2.3
10	1.9	1.9	1.5	1.6	3.0	3.9	4.0	2.8	2.6	2.2	2.2	2.7

[a] Formerly dam site.

Daily gage height, in feet, of St. Marg River near Babb, Mont., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	1.9	1.9	1.7	1.6	3.0	3.9	4.1	2.7	2.6	2.3	2.8	2.0
12	1.9	1.9	1.7	1.6	3.0	3.9	4.1	2.7	2.5	2.2	2.8	2.0
13	1.9	1.9	1.7	1.7	3.1	4.0	4.2	2.7	2.5	2.3	2.9	2.0
14	1.9	1.9	1.7	1.7	3.3	4.1	4.1	2.7	2.4	2.2	2.9	2.0
15	1.9	1.9	1.7	1.7	3.4	4.2	4.1	2.7	2.4	2.4	3.0	2.0
16	1.9	1.9	1.7	1.7	3.6	4.3	4.0	2.7	2.4	2.3	3.0	2.0
17	1.9	1.9	1.7	1.7	3.5	4.0	3.9	2.8	2.4	2.4	3.1	2.0
18	1.9	1.9	1.5	1.7	3.5	4.0	3.8	2.8	2.3	2.4	3.0	1.9
19	1.9	1.9	1.5	1.8	3.4	4.0	3.7	2.8	2.3	2.5	3.0	1.9
20	1.9	1.4	1.6	1.8	3.4	3.9	3.6	2.9	2.3	2.4	3.0	1.9
21	1.9	1.4	1.6	1.9	3.3	3.9	3.5	2.9	2.2	2.6	2.9	1.9
22	1.9	1.4	1.6	2.0	3.3	3.8	3.5	3.0	2.2	2.5	2.9	1.9
23	1.9	1.4	1.6	2.1	3.3	3.7	3.4	3.0	2.2	2.6	2.9	1.9
24	1,9	1.4	1.6	2.2	3.2	3.7	3.4	3.0	2.2	2.6	2.9	1.8
25	1.9	1.4	1.6	2.3	3.2	3.6	3.3	3.1	2.2	2.7	2.8	1.8
26	1.9	1.4	1.5	2.5	3.3	3.6	3.2	3.0	2.2	2.6	2.8	1.8
27	1.9	1.4	1.5	2.6	3.3	3.5	3.2	3.0	2.1	2.7	2.8	1.8
28	1.9	1.4	1.4	2.7	3.3	3.6	3.1	3.0	2.1	2.7	2.7	1.8
29	1.9	.....	1.4	2.7	3.3	3.6	3.1	2.9	2.1	2.8	2.7	1.8
30	1.9	.....	1.4	2.7	3.3	3.7	3.3	2.9	2.1	2.8	2.7	1.8
31	1.9	.....	1.4	.....	3.3	.....	3.3	2.8	.....	3.0	.....	1.8

NOTE.—Ice conditions January 1 to February 19, March 11 to 26; gage heights to surface of ice. Practically open-channel condition during December.

Rating table for St. Mary River near Babb, Mont., for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	65	2.20	325	3.00	725	3.80	1,300
1.50	90	2.30	365	3.10	790	3.90	1,380
1.60	115	2.40	410	3.20	855	4.00	1,460
1.70	145	2.50	455	3.30	925	4.10	1,545
1.80	175	2.60	505	3.40	995	4.20	1,630
1.90	210	2.70	555	3.50	1,070	4.30	1,715
2.00	245	2.80	610	3.60	1,145		
2.10	285	2.90	665	3.70	1,220		

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 11 discharge measurements made during 1905 and 1906. It is well defined between gage heights 1.4 and 4 feet.

Monthly discharge of St. Mary River near Babb, Mont., for 1906.

[Drainage area, 177 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	.....	.....	[a] 70	4,300	0.396	[illegible]
February	.....	.....	[a] 65	3,610	.367	[illegible]
March [b]	90	65	82.7	5,080	.467	[illegible]
April	555	90	218	13,000	1.23	[illegible]
May	1,140	610	841	51,700	4.75	[illegible]
June	1,720	925	1,300	77,400	7.34	[illegible]
July	1,630	790	1,220	75,000	6.89	[illegible]
August	790	555	649	39,900	3.67	[illegible]
September	610	285	432	25,700	2.44	[illegible]
October	725	285	421	25,900	2.38	[illegible]
November	790	555	666	39,600	3.76	[illegible]
December	555	175	283	17,400	1.60	[illegible]
The year	1,720	.....	521	379,000	2.94	[illegible]

[a] Discharge January 1 to February 19 estimated by C. C. Babb.
[b] Discharge estimated March 11 to 25.

NOTE.—Values are rated as follows: January and February, approximate; April to November, excellent; March, fair; December, good.

ST. MARY RIVER NEAR CARDSTON, ALBERTA.

This station was established September 4, 1902, near Shaw's ranch, one-fourth mile north of the boundary line between the United States and Canada and 17 miles south of Cardston, Alberta. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 19, where are given also references to publications that contain data for previous years.

Discharge measurements of St. Mary River near Cardston, Alberta, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 1	Freeman and Edson	90	126	2.90	138
May 12	W. B. Freeman	108	341	5.10	[a] 1,350
August 20	do	105	249	4.29	746
September 13	Richards and Hartman	102	231	4.13	650

[a] Meter probably not in good order, causing result to be too low.

Daily gage height, in feet, of St. Mary River near Cardston, Alberta, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec
1	3.5	4.25	3.75	.....	4.6	5.45	5.45	4.65	4.55	3.7	4.8	4.05
2	3.5	4.25	3.8	2.95	4.65	.....	5.4	4.5	4.55	3.75	.....	4.05
3	3.5	.....	4.1	2.95	4.7	5.6	5.4	4.5	4.45	3.85	4.6	4.0
4	3.75	4.45	4.2	3.0	.....	5.65	5.45	4.45	4.45	4.0	4.5	3.95
5	3.75	4.5	.....	3.05	4.7	5.75	5.5	4.4	4.4	4.1	4.5	3.9
6	3.75	4.6	3.85	3.1	4.7	5.75	5.5	4.3	4.35	4.15	4.45	3.9
7	3.75	4.6	3.7	3.15	4.65	5.7	5.5	4.25	4.3	4.15	.....	3.8
8	3.75	4.65	3.6	3.25	4.65	5.55	5.5	4.25	4.3	4.1	4.35	3.7
9	.....	4.65	3.6	3.3	4.7	5.55	5.6	4.2	4.3	4.05	4.3	3.75
10	3.75	4.65	3.5	3.3	4.75	5.55	5.6	4.2	4.25	4.1	4.3	3.7
11	3.75	4.7	.....	3.3	4.8	5.55	5.6	4.2	4.2	.....	4.3	3.6
12	3.75	4.7	.....	3.35	5.0	5.75	5.6	4.25	4.15	4.1	4.5	.....
13	3.75	4.7	4.4	3.35	5.1	.....	5.6	4.3	4.15	4.1	4.6	3.5
14	3.75	4.7	4.45	.....	5.25	5.7	5.4	4.35	4.05	4.1	4.7	3.4
15	3.75	4.7	4.5	3.35	5.35	5.6	5.35	4.4	4.0	4.1	5.05	3.35
16	3.75	4.7	4.55	3.4	5.3	5.6	5.3	4.4	3.95	4.1	.....	.....
17	3.75	4.7	.....	3.5	5.3	5.5	5.2	.....	3.9	4.1	.....	3.3
18	3.75	4.7	4.6	3.55	5.1	5.55	5.25	4.35	3.85	4.1	5.1	3.3
19	3.75	4.5	4.6	3.65	5.05	5.4	5.2	4.35	3.8	.....	5.1	3.3
20	3.75	4.5	4.6	3.75	5.05	5.35	5.15	4.3	3.8	4.2	4.9	3.35
21	3.75	4.5	4.6	3.8	5.0	5.25	5.05	4.35	.....	4.15	4.95	3.35
22	3.75	4.5	4.6	4.05	5.05	5.35	5.0	4.5	3.8	4.1	4.85	3.4
23	3.75	4.5	4.5	4.25	5.05	5.45	4.95	4.6	3.8	4.1	4.8	3.45
24	3.8	4.5	4.5	4.6	5.1	5.3	4.95	4.75	3.85	4.1	4.7	3.45
25	4.0	4.35	4.45	4.6	.....	5.25	4.9	4.95	3.85	4.1	4.55	3.5
26	.....	4.3	4.3	4.65	5.15	.....	4.85	.....	3.85	4.5	4.5	3.5
27	4.25	4.2	4.2	4.65	5.15	5.55	4.85	4.85	3.8	4.75	4.4	3.45
28	4.15	.....	3.3	4.65	5.2	5.65	4.75	4.8	3.7	5.0	4.35	3.4
29	4.2	.....	.....	.....	5.25	5.5	4.65	4.7	3.7	5.0	4.2	3.3
30	4.2	.....	.....	4.55	5.25	5.55	.....	4.65	3.65	4.95	4.15	.....
31	4.25	.....	2.90	.....	5.3	.....	4.65	4.6	.....	4.85	.....	.....

NOTE.—Ice conditions January 1 to March 31; river frozen to bottom during greater portion of ice period; gage heights are to ice surface, except for short periods when water overflowed ice. Ice conditions December 9 to 31; gage readings to water surface.

Rating table for St. Mary River near Cardston, Alberta, for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.90	153	3.70	410	4.50	960	5.30	1,900
3.00	174	3.80	460	4.60	1,055	5.40	2,055
3.10	198	3.90	515	4.70	1,155	5.50	2,215
3.20	225	4.00	575	4.80	1,260	5.60	2,385
3.30	255	4.10	640	4.90	1,370	5.70	2,565
3.40	288	4.20	710	5.00	1,490	5.80	2,755
3.50	325	4.30	785	5.10	1,620		
3.60	365	4.40	870	5.20	1,755		

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 22 discharge measurements made during 1902-1906. It is well defined between gage heights 2.5 feet and 7 feet.

Monthly discharge of St. Mary River near Cardston, Alberta, for 1906.

[Drainage area, 452 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January			[a] 100	6,150	0.221	[illegible]
February			[a] 95	5,280	.210	[illegible]
March			[b] 125	7,690	.277	[illegible]
April	1,100	160	481	28,600	1.06	[illegible]
May	1,990	1,060	1,500	92,200	3.32	[illegible]
June	2,660	1,830	2,280	136,000	5.04	[illegible]
July	2,380	1,100	1,830	113,000	4.05	[illegible]
August	1,430	710	946	58,200	2.09	[illegible]
September	1,010	385	628	37,400	1.39	[illegible]
October	1,490	410	756	46,500	1.67	[illegible]
November	1,620	675	1,100	65,500	2.43	[illegible]
December [c]	607	255	359	22,100	.794	[illegible]
The year	2,660	.....	850	619,000	1.88	[illegible]

[a] January and February estimated by C. C. Babb.
[b] Estimated from flow of St. Mary and Swiftcurrent near Babb, Mont.
[c] Flow only slightly affected by ice conditions.

NOTE.—Values are rated as follows: January and February, approximate; March, fair; April to November, excellent; December, good.

SWIFTCURRENT CREEK NEAR BABB, MONT.

This station was established April 8, 1902. It is located one-half mile northwest of Henkel's ranch and 36 miles northwest of Browning, Mont. The nearest post-office is at Babb, Mont., 2 miles below. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 21, where are given also references to publications that contain data for previous years. The length of the chain is now 15.90 feet.

Discharge measurements of Swiftcurrent Creek near Babb, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 31	Freeman and Edson	30	30	2.08	[illegible]
May 12	W. B. Freeman	55	108	3.60	[illegible]
August 18	Morse and Hartman	55	71	2.73	[illegible]
September 14	Richards and Hartman	50	53	2.38	[illegible]

[a] Meter probably out of order, causing result to be too low.

Daily gage height, in feet, of Swiftcurrent Creek near Babb, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.3	2.3	1.7	2.1	3.2	3.3	3.4	2.7	2.8	2.4	3.2	2.6
2	2.3	2.3	1.7	2.1	3.1	3.3	3.3	2.7	2.8	2.4	3.0	2.5
3	2.3	2.3	1.7	2.2	3.1	3.5	3.3	2.7	2.7	2.5	2.9	2.4
4	2.3	2.3	1.7	2.2	3.2	3.9	3.3	2.7	2.7	2.5	2.9	2.4
5	2.3	2.3	1.8	2.3	3.3	3.8	3.4	2.7	2.7	2.6	2.9	2.3
6	2.3	2.3	1.8	2.4	3.3	3.6	3.4	2.6	2.7	2.7	2.9	2.3
7	2.3	2.3	1.9	2.5	3.2	3.5	3.4	2.6	2.6	2.6	2.8	2.3
8	2.3	2.3	1.9	2.6	3.2	3.5	3.4	2.6	2.6	2.6	2.8	2.3
9	2.3	2.3	1.9	2.8	3.1	3.5	3.3	2.6	2.6	2.6	2.8	2.1
10	2.3	2.3	1.9	2.8	3.3	3.6	3.3	2.5	2.7	2.6	2.8	2.1
11	2.3	2.3	2.3	2.8	3.4	3.8	3.3	2.5	2.7	2.7	2.9	2.0
12	2.3	2.3	2.3	2.7	3.6	3.9	3.3	2.5	2.6	2.7	2.9	2.0
13	2.3	2.3	2.3	2.7	3.6	4.1	3.2	2.5	2.5	2.7	2.9	2.0
14	2.3	2.3	2.3	2.6	3.6	3.9	3.2	2.5	2.4	2.7	3.0	2.0
15	2.3	2.3	2.3	2.7	3.7	3.7	3.1	2.6	2.4	2.7	3.0	2.0
16	2.3	2.3	2.3	2.7	3.7	3.5	3.1	2.6	2.4	2.7	3.1	2.0
17	2.3	2.3	2.3	2.8	3.5	3.5	3.0	2.6	2.3	2.7	3.3	2.0
18	2.3	2.3	2.3	2.8	3.4	3.4	3.0	2.6	2.3	2.7	3.2	2.0
19	2.3	2.3	2.3	2.9	3.1	3.4	3.0	2.6	2.3	2.7	3.1	2.0
20	2.3	2.3	2.3	2.9	3.1	3.3	2.9	2.7	2.2	2.7	3.1	1.9
21	2.3	1.6	2.3	3.0	3.2	3.3	2.9	2.7	2.2	2.9	3.0	1.9
22	2.3	1.6	2.3	3.3	3.2	3.3	2.9	2.8	2.2	3.0	3.0	1.8
23	2.3	1.6	2.3	3.5	3.3	3.3	2.8	2.8	2.2	3.0	2.9	1.8
24	2.3	1.6	2.3	3.5	3.3	3.3	2.8	2.8	2.2	3.2	2.8	1.8
25	2.3	1.6	2.3	3.5	3.3	3.3	2.8	2.9	2.2	3.6	2.8	1.8
26	2.3	1.6	1.9	3.4	3.3	3.4	2.8	2.9	2.3	3.7	2.8	1.7
27	2.3	1.6	2.0	3.4	3.3	3.4	2.7	2.9	2.3	3.9	2.7	1.7
28	2.3	1.6	2.0	3.3	3.3	3.4	2.7	2.8	2.3	3.9	2.6	1.7
29	2.3	.....	2.0	3.3	3.3	3.5	2.7	2.8	2.3	3.9	2.6	1.7
30	2.3	.....	2.1	3.2	3.3	3.5	2.7	2.8	2.4	3.7	2.6	1.7
31	2.3	.....	2.1	.....	3.3	.....	2.7	2.8	.....	3.5	.....	1.7

NOTE.—Ice conditions January 1 to February 20, March 11 to 25, readings are to top of ice. Practically open-channel conditions during December.

Rating table for Swiftcurrent Creek near Babb, Mont., for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.70	7	2.40	130	3.10	385	3.80	800
1.80	18	2.50	160	3.20	435	3.90	875
1.90	30	2.60	190	3.30	485	4.00	950
2.00	44	2.70	225	3.40	540	4.10	1,025
2.10	60	2.80	260	3.50	600	4.20	1,100
2.20	80	2.90	300	3.60	665	4.30	1,175
2.30	105	3.00	340	3.70	730		

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 11 discharge measurements made during 1905 and 1906. It is well defined between gage heights 2.1 feet and 4.5 feet.

Monthly discharge of Swiftcurrent Creek near Babb, Mont., for 1906.

[Drainage area, 101 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	.....	.....	[a] 30	1,840	0.297	0.34
February	.....	.....	[a] 30	1,670	.297	.31
March	60	7	[b] 29.5	1,810	.292	.34
April	600	60	299	17,800	2.96	3.30
May	730	385	500	30,700	4.95	5.71
June	1,020	485	623	37,100	6.17	6.88
July	540	225	381	23,400	3.77	4.35
August	300	160	220	13,500	2.18	2.51
September	260	80	151	8,980	1.50	1.67
October	875	130	347	21,300	3.44	3.97
November	485	190	308	18,300	3.05	3.40
December	190	7	55.5	3,410	.550	.63
The year	1,020	7	248	180,000	2.45	33.41

[a] January and February estimated by C. C. Babb. [b] Discharge estimated March 11 to 25.

NOTE.—Values are rated as follows: January to March, approximate; April to November, excellent; December, good.

KENNEDY CREEK NEAR BABB, MONT.

This station was established October 17, 1903. It is located 50 feet above the ford on the road from Altyn, Mont., to Cardston, Alberta, and is 37 miles northwest of Browning, Mont., and about 4 miles north of Babb post-office. The station is situated where the creek emerges from the canyon, about 1½ miles above its confluence with St. Mary River. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 24, where are given also references to publications that contain data for previous years.

Discharge measurements of Kennedy Creek near Babb, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 31	Freeman and Edson	19	19	5.74	[illegible]
May 12	W. B. Freeman	57	72	6.38	[a] [illegible]
August 18	Morse and Hartman	50	34	5.78	[illegible]
September 14	Richards and Hartman	51	43	5.91	[illegible]

[a] Meter probably out of order, causing result to be too low.

RED RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Red River rises in Lake Traverse, on the boundary line between South Dakota and Minnesota, and flows almost due north into Lake Winnipeg, its waters finally reaching Hudson Bay through Nelson River. It drains a large area in the United States, including portions of Minnesota and of South and North Dakota.

RED RIVER AT GRAND FORKS, N. DAK.

This station was established May 26, 1901. It is located at the Northern Pacific Railway bridge at Grand Forks, N. Dak. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 29, where are given also references to publications that contain data for previous years.

Discharge measurements of Red River at Grand Forks, N. Dak., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
December 22	E. F. Chandler	208	1,110	[a] 9.05	[b] 1,840
1906.					
January 29	Chandler and Richards	207	1,060	[c] 9.45	[b] 1,770
March 5	do	205	949	[d] 9.51	[b] 1,550
March 23	do	207	1,110	[e] 10.24	[b] 1,880
April 9	R. Richards	576	9,140	32.40	23,000
August 11	E. F. Chandler	161	1,510	10.27	3,710
November 5	do	160	1,140	8.21	2,410
December 21	do	198	1,070	[f] 8.59	[b] 1,700

[a] Gage height to under side of ice=8.02.
[b] Ice measurements; gage heights are to the water surface in a hole in the ice.
[c] Gage height to under side of ice=7.79.
[d] Gage height to under side of ice=7.01.
[e] Gage height to under side of ice=7.82.
[f] Gage height to under side of ice=7.71.

Daily gage height, in feet, of Red River at Grand Forks, N. Dak., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1				17.8	18.5	16.4	13.1	9.6	8.7	8.4	7.9	8.8
2				21.9	17.8	16.3	13.2	9.9	9.1	8.5	8.35	.....
3		9.5	9.5	25.1	17.4	16.1	13.25	10.1	9.15	8.4	8.35	.....
4				27.9	17.25	15.8	13.8	10.4	9.2	8.25	8.3	.....
5			9.5	30.55	17.25	15.4	14.4	10.6	9.05	8.3	8.25	.....
6	9.35			32.5	17.25	15.25	14.65	10.25	8.9	8.4	8.4	.....
7				33.5	17.2	15.1	14.4	10.85	8.55	8.45	8.05	.....
8				33.3	17.1	14.75	14.15	10.8	8.4	8.3	8.1	8.9
9				32.25	16.9	14.5	13.85	10.6	8.3	8.1	8.2	.....
10		9.35	9.7	31.0	16.7	14.35	13.5	10.5	8.3	7.85	8.5	.....
11				30.1	16.35	14.2	13.0	10.25	8.3	8.0	8.25	.....
12				29.25	16.0	14.2	12.75	10.1	8.2	7.85	8.25	.....
13	9.2			28.9	15.65	14.0	12.35	9.85	8.25	7.8	8.1	.....
14				29.5	15.25	13.85	11.95	9.65	8.1	7.7	8.1	.....
15				31.1	15.5	13.65	11.65	9.55	7.9	7.8	8.1	8.4
16				34.0	16.15	13.3	11.3	9.4	7.8	7.7	7.6	.....
17		9.2	10.3	35.5	16.75	13.0	11.1	9.3	7.8	7.6	7.2	.....
18				36.0	16.75	12.85	10.85	9.2	7.9	7.7	7.15	.....
19				35.85	16.9	12.8	10.7	9.05	7.85	7.6	7.4	.....
20	9.4			35.15	17.2	13.1	10.5	9.0	8.0	7.55	.....	.....
21				34.2	17.1	13.35	10.45	9.0	7.95	7.55	7.5	.....
22				32.9	17.05	13.3	10.5	9.0	8.0	7.45	.....	8.4
23			10.2	31.2	16.85	13.1	10.25	8.95	8.1	7.4	.....	.....
24		9.15	10.1	29.4	16.7	13.0	10.15	9.0	8.1	7.35	7.6	.....
25				27.35	16.45	12.9	10.2	9.15	8.2	7.3	.....	.....
26				25.5	16.3	12.8	10.2	9.1	8.6	7.25	.....	.....
27	9.5			23.55	16.7	12.85	10.2	8.9	8.65	7.3	.....	.....
28				22.0	17.25	13.15	10.0	8.95	8.55	7.4	.....	.....
29	9.45			20.55	17.35	13.2	9.8	9.2	8.4	7.7	.....	8.4
30				19.4	17.05	13.2	9.8	9.15	8.5	8.4	.....	.....
31			14.0	.....	16.8	.....	9.7	8.8	.....	7.6	.....	.....

NOTE.—Ice conditions January 1 to April 8; gage heights were to water surface; average ice thickness, 2 feet. Ice condition November 13 to December 31; average thickness 1.1 feet.

Rating table for Red River at Grand Forks, N. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
7.00	1,800	8.80	2,700	11.20	4,140	22.00	12,790
7.10	1,846	8.90	2,755	11.40	4,270	23.00	13,730
7.20	1,892	9.00	2,810	11.60	4,400	24.00	14,670
7.30	1,939	9.10	2,865	11.80	4,530	25.00	15,640
7.40	1,986	9.20	2,920	12.00	4,660	26.00	16,640
7.50	2,034	9.30	2,975	12.20	4,790	27.00	17,650
7.60	2,082	9.40	3,030	12.40	4,920	28.00	18,670
7.70	2,131	9.50	3,090	12.60	5,060	29.00	19,720
7.80	2,180	9.60	3,150	12.80	5,200	30.00	20,790
7.90	2,230	9.70	3,210	13.00	5,340	31.00	21,880
8.00	2,280	9.80	3,270	14.00	6,040	32.00	22,980
8.10	2,330	9.90	3,330	15.00	6,790	33.00	24,100
8.20	2,380	10.00	3,390	16.00	7,560	34.00	25,250
8.30	2,430	10.20	3,510	17.00	8,360	35.00	26,400
8.40	2,480	10.40	3,630	18.00	9,190	36.00	27,550
8.50	2,535	10.60	3,750	19.00	10,040		
8.60	2,590	10.80	3,880	20.00	10,940		
8.70	2,645	11.00	4,010	21.00	11,850		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1901-1906. It is well defined.

Monthly discharge of Red River at Grand Forks, N. Dak., for 1906.

[Drainage area, 25,000 square miles.[a]]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January			[b] 1,750	108,000	0.070	0.08
February			[b] 1,590	88,300	.064	.07
March			[b] 1,890	116,000	.076	.09
April	27,600	7,000	[c] 19,800	1,180,000	.792	.88
May	9,620	6,980	8,220	505,000	.329	.38
June	7,880	5,200	6,060	361,000	.242	.27
July	6,530	3,210	4,560	280,000	.182	.21
August	3,910	2,700	3,180	196,000	.127	.15
September	2,920	2,180	2,470	147,000	.099	.11
October	2,540	1,920	2,200	135,000	.088	.10
November			[d] 2,150	128,000	.086	.10
December			[b] 1,630	100,000	.065	.07
The year			4,620	3,340,000	.185	2.51

[a] Revised since 1905 report.
[b] Estimated from gage heights and ice measurements.
[c] Discharge estimated April 1 to 8.
[d] Discharge November 20 to 30 estimated.

NOTE.—Values are rated as follows: January to March and December, fair; April and November, good; May to October, excellent.

OTTERTAIL RIVER NEAR FERGUS FALLS, MINN.

This station was established May 9, 1904. It is located at Three-mile Bridge, about 3½ miles northeast of Fergus Falls, Minn. The conditions at this station and the bench marks[a] are described in Water-Supply Paper No. 171, page 33, where are given also references to publications that contain data for previous years.

[a] During 1906 the gage was attached to the guard rail at station "20" on the lower side of the bridge. The bench mark is the center of the lowest bolt holding the vertical strap iron tie-rod against the face of the stone abutment on the right bank; it is about 3 feet above the lower angle of the abutment; elevation; 7.75 feet above gage datum.

Discharge measurements of Ottertail River near Fergus Falls, Minn., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
September 4	R. Richards	98	240	3.84	759
November 4	E. F. Chandler	98	202	3.49	539
1906.					
May 14	E. F. Chandler	93	225	3.89	786
June 25	do	92	264	4.30	1,010

Daily gage height, in feet, of Ottertail River near Fergus Falls, Minn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1				4.8	3.7	3.95	4.25	3.95	3.85	3.7	3.7	
2				4.6	3.75	4.0	4.25	3.95	3.85	3.7	3.7	
3				4.3	3.8	4.0	4.25	3.95	3.85	3.7	3.7	
4				4.0	3.8	4.0	4.25	3.95	3.85	3.7	3.7	
5				4.0	3.8	4.0	4.25	3.9	3.85	3.7	3.7	
6				3.5	3.8	4.1	4.25	3.9	3.85	3.7	3.65	
7				3.2	3.8	4.1	4.25	3.9	3.85	3.7	3.65	
8				3.2	3.8	4.15	4.25	3.85	3.85	3.7	3.65	
9				3.3	3.85	4.2	4.25	3.85	3.85	3.7	3.6	
10				3.3	3.85	4.2	4.2	3.8	3.85	3.7	3.6	
11	4.55			3.4	3.85	4.2	4.15	3.8	3.8	3.7	3.6	
12				3.4	3.85	4.2	4.15	3.8	3.8	3.7	3.6	
13				3.4	3.85	4.2	4.15	3.8	3.8	3.7	3.6	
14			4.7	3.4	3.9	4.2	4.15	3.8	3.8	3.7	3.6	
15				3.4	3.9	4.2	4.15	3.75	3.8	3.7	3.65	
16		4.6		3.4	3.9	4.2	4.15	3.75	3.8	3.7	3.65	
17				3.4	3.9	4.2	4.1	3.75	3.8	3.7	3.7	
18				3.4	3.9	4.2	4.1	3.75	3.8	3.7	3.9	
19				3.4	3.9	4.2	4.1	3.75	3.8	3.7	4.0	
20				3.4	3.9	4.2	4.0	3.7	3.8	3.7	4.5	
21				3.45	3.9	4.2	4.0	3.7	3.85	3.75	4.8	
22				3.45	3.9	4.2	4.0	3.7	3.8	3.8	4.8	4.65
23				3.45	3.9	4.2	4.0	3.75	3.8	3.8	4.8	
24				3.5	3.9	4.2	4.0	3.8	3.75	3.8	4.8	
25				3.5	3.95	4.25	4.0	3.85	3.75	3.75		
26	4.7			3.6	3.95	4.25	4.0	3.85	3.75	3.75		
27				3.65	3.95	4.25	4.0	3.85	3.75	3.7		
28				3.65	3.95	4.25	4.0	3.85	3.7	3.7		
29				3.65	3.95	4.25	4.0	3.85	3.7	3.7		
30				3.7	3.95	4.25	4.0	3.85	3.7	3.7		
31			4.8		3.95		3.95	3.85		3.7		

NOTE.—Ice conditions January 1 to April 6, also November 19 to December 31; gage heights were to water surface. The following comparative readings were made:

Comparative ice and water gage heights of Ottertail River near Fergus Falls, Minn.

Date.	Water surface.	Top of ice.	Thickness of ice.
January 11	4.55	4.65	1.3
January 26	4.7	4.8	1.6
February 16	4.6	4.7	1.7
March 14	4.7	4.8	1.6

Rating table for Ottertail River near Fergus Falls, Minn., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.20	402	3.50	552	3.80	726	4.10	921
3.30	449	3.60	607	3.90	789	4.20	987
3.40	499	3.70	665	4.00	855		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 12 discharge measurements made during 1904–1906. It is well defined between gage heights 2.8 feet and 3.8 feet.

Monthly discharge of Ottertail River near Fergus Falls, Minn., for 1906.

[Drainage area, 1,310 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	665	402	[a] 517	30,800	0.395	0.44
May	822	665	772	47,500	.589	[illegible]
June	1,020	822	965	57,400	.737	[illegible]
July	1,020	822	932	57,300	.711	[illegible]
August	822	665	742	45,600	.566	[illegible]
September	758	665	727	43,300	.555	[illegible]
October	726	665	674	41,400	.515	[illegible]
November (1–24)	855	607	[b] 686	32,600	.524	[illegible]
The period				356,000		

[a] Discharge estimated April 1 to 6. [b] Discharge estimated November 20 to 24.

NOTE.—Values are rated as follows: April and November, good; May to October, excellent.

SHEYENNE RIVER NEAR HAGGART, N. DAK.

This station was established March 22, 1902. It is located near the station of Haggart, on the Northern Pacific Railway, 6 miles west of Fargo, N. Dak., at a private wagon bridge about one-fourth mile north of the railroad. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 35, where are given also references to publications that contain data for previous years.

Discharge measurements of Sheyenne River near Haggart, N. Dak., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 30	R. Richards	53	175	6.60	[illegible]
June 22	Chandler and Richards	46	154	4.70	[illegible]
July 11	R. Richards	47	147	4.60	[illegible]
July 29	Hanna and Chandler	44	134	4.42	[illegible]
August 22	R. Richards	54	216	6.01	[illegible]
November 18	E. F. Chandler	39	105	3.64	[illegible]
1906.					
April 14	E. F. Chandler	72	530	10.89	[illegible]
June 27	do	48	208	5.92	[illegible]
September 10	Grover and Chandler	39	105	3.45	[illegible]

Daily gage height, in feet, of Sheyenne River near Haggart, N. Dak., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	9.5	6.2	6.7	5.4	4.7	3.3	3.3	3.2	3.5
2	.....	.....	.....	9.65	6.2	6.5	5.5	4.7	3.3	3.3	3.2	.....
3	.....	.....	.....	8.7	6.2	6.4	5.5	4.6	3.3	3.3	3.2	.....
4	.....	.....	.....	7.2	6.1	6.2	5.4	4.6	3.3	3.3	3.2	.....
5	.....	.....	.....	7.1	6.1	6.2	5.3	4.5	3.2	3.2	3.2	.....
6	4.5	.....	.....	6.6	6.1	6.1	5.1	4.4	3.2	3.2	3.2	.....
7	.....	.....	.....	6.7	6.0	6.1	5.0	4.4	3.2	3.2	3.2	.....
8	.....	.....	.....	7.2	6.0	6.1	4.7	4.3	3.1	3.2	3.2	.....
9	.....	.....	.....	7.5	5.7	6.0	4.7	4.3	3.1	3.2	3.3	.....
10	.....	.....	.....	8.1	5.6	6.0	4.6	4.3	3.0	3.2	3.3	.....
11	.....	.....	.....	9.1	5.4	6.0	4.6	4.2	3.0	3.2	3.3	3.9
12	.....	.....	.....	9.7	5.3	5.7	4.6	4.2	3.0	3.2	3.3	.....
13	.....	.....	.....	10.3	5.2	5.7	4.5	4.2	3.0	3.2	3.3	.....
14	.....	.....	.....	10.6	5.0	5.6	4.5	4.1	3.0	3.2	3.3	.....
15	.....	.....	.....	11.5	4.7	5.5	4.5	4.1	3.1	3.2	3.3	.....
16	.....	5.6	5.6	11.7	5.1	5.5	4.5	4.0	3.1	3.2	3.4	.....
17	.....	.....	.....	11.6	5.2	5.5	4.4	4.0	3.2	3.2	3.4	.....
18	.....	.....	.....	11.2	5.5	5.6	4.3	3.7	3.2	3.2	3.4	.....
19	.....	.....	.....	10.7	6.0	5.7	4.3	3.7	3.3	3.2	3.4	.....
20	.....	.....	.....	10.5	6.2	5.7	4.2	3.6	3.3	3.2	3.4	.....
21	.....	.....	.....	10.2	6.1	5.6	4.2	3.6	3.4	3.2	3.4	.....
22	.....	.....	.....	9.7	5.7	5.5	4.2	3.6	3.4	3.2	3.4	.....
23	.....	.....	.....	9.2	5.6	5.5	4.1	3.6	3.5	3.2	3.4	.....
24	.....	.....	8.6	8.4	5.5	5.5	4.1	3.5	3.5	3.2	3.5	.....
25	.....	.....	9.2	7.6	5.7	5.5	4.1	3.5	3.5	3.2	3.5	.....
26	4.6	.....	8.7	7.2	6.0	5.6	4.1	3.5	3.4	3.2	3.5	.....
27	.....	.....	8.0	6.7	6.5	5.6	4.2	3.5	3.4	3.2	3.5	.....
28	.....	.....	7.6	6.6	7.2	5.5	4.4	3.4	3.4	3.2	3.5	.....
29	.....	.....	8.1	6.5	7.1	5.5	4.5	3.4	3.3	3.2	3.5	.....
30	.....	.....	8.4	6.2	7.1	5.4	4.6	3.4	3.3	3.2	3.5	.....
31	.....	.....	9.2	.....	7.0	.....	4.7	3.3	.....	3.2	.....	4.0

NOTE.—Ice conditions January 1 to April 3. Gage heights probably to water surface. Thickness of ice, 1.8 feet approximately. Ice conditions also November 20 to December 31.

Rating table for Sheyenne River near Haggart, N. Dak., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.00	32	4.30	131	5.60	269	7.80	554
3.10	38	4.40	140	5.70	281	8.00	580
3.20	44	4.50	149	5.80	294	8.20	606
3.30	51	4.60	159	5.90	307	8.40	632
3.40	58	4.70	169	6.00	320	8.60	658
3.50	65	4.80	179	6.20	346	8.80	684
3.60	72	4.90	189	6.40	372	9.00	710
3.70	80	5.00	200	6.60	398	10.00	840
3.80	88	5.10	211	6.80	424	11.00	970
3.90	96	5.20	222	7.00	450	12.00	1,100
4.00	104	5.30	233	7.20	476		
4.10	113	5.40	245	7.40	502		
4.20	122	5.50	257	7.60	528		

NOTE.—The above table is applicable only for open-channel conditions. It is based on the discharge measurements made during 1903–1906. It is fairly well defined.

Monthly discharge of Sheyenne River near Haggart, N. Dak., for 1905–6.

[Drainage area, 5,400 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec-ft. per sq. mile.	Depth in inches.
1905.[a]						
April (3-30)	385	113	201	11,200	0.037	0.04
May	814	96	326	20,000	.060	.07
June	333	169	206	12,300	.038	.04
July	398	88	177	10,900	.033	.04
August	684	104	303	18,600	.056	.06
September	159	80	120	7,140	.022	.02
October	104	65	79.7	4,900	.015	.02
November	96	.....	[b] 76.5	4,550	.014	.02
The period				89,600		
1906.						
April	1,060	346	682	40,600	0.126	0.14
May	476	169	311	19,100	.058	.07
June	411	245	295	17,600	.055	.06
July	257	113	162	9,960	.030	.03
August	169	51	104	6,400	.019	.02
September	65	32	47.5	2,830	.0088	.01
October	51	44	44.9	2,760	.0083	.01
November	58	44	[c] 52.6	3,130	.0097	.01
The period				102,000		

[a] For 1905 gage heights see Water-Supply Paper No. 171.
[b] Discharge estimated November 1 to 17, 1905.
[c] Discharge estimated November 24 to 30, 1906.

NOTE.—Values are rated as follows: June and July, 1905, excellent; remainder of 1905, good. It is impossible to determine the accuracy of the 1906 values which are subject to large errors, probably being much too low. This is due to the appointment of a new observer for 1906, who recorded the gage height as 0.4 foot less than the hydrographer on the days when measurements were made.

RED LAKE RIVER AT CROOKSTON, MINN.

The gaging station was established May 19, 1901. It is located at the bridge connecting Robert and St. Paul streets, Crookston, known as the "Sampson Addition" bridge. It is about one-sixth mile west of the Great Northern Railway station. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 37, where are given also references to publications that contain data for previous years.

Discharge measurements of Red Lake River at Crookston, Minn., 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
November 20	E. F. Chandler	176	628	5.90	1.[illegible]
1906.					
February 12	Chandler and Richards	174	471	6.75	[illegible]
April 16	E. F. Chandler	246	3,660	20.13	14.1[illegible]
June 30	do	180	715	6.72	1.9[illegible]
September 11	Grover and Chandler	173	405	4.80	[illegible]

[a] Ice measurement: gage height to undersurface of ice is 5.29 feet; ice thickness 0.7 foot to 2.7 feet. The discharge was about 45 per cent of the open-channel rating for gage height 6.75 feet.

Daily gage height, in feet, of Red Lake River at Crookston, Minn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.8	7.0	7.0	12.4	10.4	8.05	6.7	5.7	5.4	5.0	5.2	5.0
2	6.7	.....	.....	14.05	10.0	8.15	6.5	5.9	5.4	5.0	5.0	5.2
3	6.6	.....	.....	14.46	9.6	7.92	6.65	5.8	5.85	(5.25)	5.0	5.1
4	6.7	.....	6.85	15.77	9.5	7.8	6.45	5.5	5.55	5.5	4.5	5.3
5	6.7	.....	.....	15.3	9.5	(7.75)	6.55	5.6	5.3	5.25	4.2	5.0
6	6.8	7.1	7.0	12.39	9.6	7.72	6.5	5.65	5.2	5.2	4.4	5.4
7	6.8	.....	6.75	12.5	9.45	7.45	6.4	5.8	5.5	5.5	4.5	5.5
8	6.7	.....	6.8	10.3	9.25	7.4	6.2	5.35	5.25	5.05	4.5	5.6
9	6.8	.....	.....	11.15	9.1	7.4	6.15	5.6	5.5	4.9	4.6	5.5
10	6.9	7.2	.....	11.67	8.95	7.45	6.05	5.7	4.85	4.8	4.2	5.6
11	6.8	.....	7.1	12.1	8.9	7.55	6.2	5.65	5.05	5.15	4.3	5.6
12	6.7	.....	.....	13.18	8.8	7.3	6.15	5.5	5.1	4.75	4.3	5.6
13	6.7	.....	.....	14.41	8.7	7.2	6.1	5.55	5.35	5.0	4.2	5.5
14	6.7	.....	.....	19.78	8.6	7.08	6.05	5.7	4.85	4.6	4.1	5.4
15	.....	.....	6.9	20.97	8.7	7.0	6.0	5.9	5.05	5.1	4.5	5.6
16	.....	.....	.....	19.81	8.6	6.8	6.0	6.6	5.35	5.05	4.2	5.5
17	.....	6.5	.....	18.45	8.55	6.6	5.9	6.0	5.5	4.95	4.2	5.6
18	.....	.....	6.8	16.92	8.9	6.45	5.9	6.15	4.5	4.6	4.2	5.6
19	.....	.....	.....	15.6	8.7	6.85	5.9	5.9	5.0	4.15	4.2	5.6
20	.....	6.55	7.25	14.6	8.5	6.65	5.9	5.8	5.4	4.5	4.2	5.6
21	.....	.....	.....	13.75	8.25	6.4	6.0	6.0	5.25	4.7	4.9	5.5
22	.....	.....	7.05	13.0	8.05	6.65	6.0	5.7	5.05	4.4	4.7	5.6
23	.....	.....	7.15	12.4	7.85	6.65	5.9	5.25	4.9	4.5	4.3	5.6
24	.....	6.5	7.2	12.1	7.75	6.65	5.85	5.55	5.35	4.5	4.3	5.6
25	7.1	.....	6.95	11.9	7.85	6.6	5.9	5.55	5.5	4.6	4.7	5.6
26	.....	.....	7.05	11.5	7.72	6.55	5.9	5.5	5.55	4.3	4.3	5.6
27	.....	6.8	7.1	11.2	7.55	6.68	5.8	5.6	5.5	4.2	4.9	5.6
28	7.2	.....	7.15	11.0	7.5	6.6	5.75	5.75	5.25	4.4	5.0	5.6
29	.....	.....	9.62	10.9	7.7	6.65	5.8	5.4	5.0	4.4	4.9	5.6
30	.....	.....	11.1	.....	7.7	6.62	5.8	5.3	5.35	4.5	5.0	5.6
31	7.4	.....	11.45	.....	7.8	.....	5.65	5.5	.....	4.7	.....	5.6

NOTE.—Ice conditions January 1 to April 4, there being a narrow, open channel from January 1 to 24. Gage readings to water surface January 1 to 14, and to top of ice during remainder of ice period. Ice condition also during December, except for narrow channel during part of the month.

Rating table for Red Lake River at Crookston, Minn., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.10	615	5.20	1,220	6.30	1,950	7.80	3,095
4.20	660	5.30	1,280	6.40	2,020	8.00	3,255
4.30	710	5.40	1,340	6.50	2,095	8.20	3,415
4.40	760	5.50	1,400	6.60	2,170	8.40	3,575
4.50	815	5.60	1,465	6.70	2,245	8.60	3,735
4.60	870	5.70	1,530	6.80	2,325	8.80	3,895
4.70	925	5.80	1,600	6.90	2,395	9.00	4,055
4.80	980	5.90	1,670	7.00	2,470	9.20	4,225
4.90	1,040	6.00	1,740	7.20	2,620	9.40	4,395
5.00	1,100	6.10	1,810	7.40	2,775		
5.10	1,160	6.20	1,880	7.60	2,935		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 24 discharge measurements made during 1902–1906. It is well defined. Above gage height 9 feet the rating curve is a tangent, the difference being 85 per tenth.

Monthly discharge of Red Lake River at Crookston, Minn., for 1906.

[Drainage area, 5,520 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January [a]			1,500	92,200	0.272	0.31
February [a]			1,020	56,600	.185	.19
March [a]			1,500	92,200	.272	.31
April [b]	14,200	5,880	8,090	481,000	1.47	1.64
May	5,240	2,860	3,780	232,000	.685	.79
June	3,380	2,020	2,540	151,000	.460	.51
July	2,240	1,500	1,800	111,000	.326	.38
August	1,840	1,250	1,520	93,500	.275	.32
September	1,640	815	1,260	75,000	.228	.25
October	1,400	638	983	60,400	.178	.21
November	1,220	660	836	49,700	.151	.17
The period				1,490,000		

[a] Estimated from gage heights and one ice measurement.
[b] Discharge, April 1 to 4, estimated.

NOTE.—Values are rated as follows: January and March, approximate; February, fair; April to October, excellent; November good.

PEMBINA RIVER NEAR NECHE, N. DAK.

The gaging station was established April 29, 1903. It is located at the Great Northern Railway bridge, two-thirds of a mile north of the railroad station at Neche, N. Dak. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 40, where are given also references to publications that contain data for previous years.

Discharge measurements of Pembina River near Neche, N. Dak., in 1904 and 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1904.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 18	R. Richards	85	634	11.85	[a] 1,[illegible]
April 26	do	92	1,490	18.12	3,[illegible]
May 23	do	96	909	13.28	2,[illegible]
June 8	E. C. Murphy	86	837	12.04	1,[illegible]
July 9	R. Richards	79	488	8.51	[illegible]
August 16	do	72	299	5.70	[illegible]
October 17	L. L. Wilcox	70	274	5.22	[illegible]
1906.					
April 23	R. Richards	70	220	4.47	[illegible]
June 11	E. F. Chandler	70	246	4.88	[illegible]
August 15	do	66	157	3.67	[illegible]
October 22	do	66	178	3.67	[illegible]

[a] Discharge affected by ice jam below station.

Daily gage height, in feet, of Pembina River near Neche, N. Dak., for 1906. [a]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	4.0	4.2	4.1	4.4	3.5	3.65	3.7	[illegible]
2	7.5	4.15	4.3	4.3	3.5	3.7	3.7	[illegible]
3	8.5	4.15	4.35	4.2	3.5	3.7	3.7	[illegible]
4	9.0	4.15	4.35	4.1	3.5	3.7	3.75	[illegible]
5	8.5	4.1	4.3	4.2	3.5	3.65	3.75	[illegible]
6	8.0	4.1	4.3	4.3	3.5	3.65	3.75	[illegible]
7	7.5	4.1	4.3	4.4	3.5	3.65	3.75	[illegible]
8	6.5	4.05	4.4	4.35	3.5	3.65	3.75	[illegible]
9	6.0	4.05	4.45	4.3	3.5	3.65	3.75	[illegible]
10	5.5	4.0	4.6	4.2	3.6	3.65	3.75	[illegible]

[a] 1904 gage heights published in Water-Supply Paper No. 130.

Daily gage height, in feet, of Pembina River near Neche, N. Dak., for 1906—Continued.

Days.	Apr.	May.	June.	July.	Aug.	Sept	Oct.	Nov.
11	5.0	3.95	4.65	4.15	3.7	3.65	3.7	3.3
12	4.9	3.95	4.6	4.1	3.7	3.65	3.7	3.05
13	4.8	3.9	4.5	3.9	3.7	3.65	3.7	3.05
14	4.8	3.9	4.4	3.8	3.7	3.8	3.75	3.1
15	4.85	3.9	4.3	3.8	3.65	3.8	3.75	3.1
16	4.8	3.9	4.2	.....	3.65	3.75	3.7	3.2
17	4.8	3.9	4.1	3.7	3.65	3.75	3.7	3.25
18	4.75	3.9	4.1	3.7	3.65	3.75	3.7	3.35
19	4.7	3.95	4.45	3.65	3.65	3.7	3.7	3.35
20	4.6	3.95	4.45	3.6	3.6	3.7	3.7	.....
21	4.55	4.1	4.75	3.6	3.6	3.7	3.7	.....
22	4.5	4.0	4.75	3.6	3.6	3.7	3.7	.....
23	4.45	4.0	4.6	3.55	3.6	3.8	3.7	.....
24	4.4	4.0	4.5	3.5	3.6	3.85	3.7	.....
25	4.4	3.95	4.0	3.55	3.65	3.85	3.7	.....
26	4.35	3.95	4.0	3.5	3.65	3.85	3.7	.....
27	4.3	3.9	4.5	3.5	3.65	3.85	3.65	.....
28	4.25	3.9	4.5	3.5	3.65	3.8	3.65	.....
29	4.2	3.9	4.75	3.55	3.65	3.8	3.65	.....
30	4.2	3.9	4.6	3.5	3.65	3.75	3.65	.....
31	.....	4.0	.....	3.5	3.65	.....	3.65	.....

NOTE.—Ice conditions January 1 to April 7; also November 18 to December 31.

Rating table for Pembina River near Neche, N. Dak.

JANUARY 1 TO DECEMBER 31, 1904.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.50	131	6.10	442	7.70	794	10.60	1,448
4.60	147	6.20	464	7.80	816	10.80	1,494
4.70	164	6.30	486	7.90	838	11.00	1,540
4.80	181	4.40	508	8.00	860	12.00	1,770
4.90	199	6.50	530	8.20	904	13.00	2,000
5.00	217	6.60	552	8.40	948	14.00	2,230
5.10	236	7.70	574	8.60	992	15.00	2,460
5.20	255	6.80	596	8.80	1,036	16.00	2,690
5.30	275	6.90	618	9.00	1,080	17.00	2,930
5.40	295	7.00	640	9.20	1,126	18.00	3,170
5.50	315	7.10	662	9.40	1,172	19.00	3,410
5.60	336	7.20	684	9.60	1,218	20.00	3,650
5.70	357	7.30	706	9.80	1,264	21.00	3,890
5.80	378	7.40	728	10.00	1,310		
5.90	399	7.50	750	10.20	1,356		
6.00	420	7.60	772	10.40	1,402		

JANUARY 1 TO DECEMBER 31, 1906.[b]

3.00	79	4.20	231	5.40	470	7.00	800
3.10	85	4.30	250	5.50	490	7.20	842
3.20	92	4.40	270	5.60	510	7.40	884
3.30	100	4.50	290	5.70	530	7.60	926
3.40	109	4.60	310	5.80	550	7.80	968
3.50	119	4.70	330	5.90	570	8.00	1,010
3.60	130	4.80	350	6.00	590	8.20	1,052
3.70	143	4.90	370	6.20	632	8.40	1,094
3.80	158	5.00	390	6.40	674	8.60	1,136
3.90	175	5.10	410	6.60	716	8.80	1,178
4.00	193	5.20	430	6.80	758	9.00	1,220
4.10	212	5.30	450				

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904. It is well defined between gage heights 5.0 feet and 18.0 feet.

[b] This table is applicable only for open-channel conditions. It is based on 9 discharge measurements made during 1905–6. It is well defined between gage heights 3.2 feet and 6.0 feet.

Monthly discharge of Pembina River near Neche, N. Dak., for 1904–1906.[a]

[Drainage area, 2,940 square miles.[b]]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
1904.[c]						
April (8–30)[d]	3,580	217	1,920	87,600	0.653	0.56
May	3,870	1,420	2,640	162,000	.898	1.04
June	2,530	926	1,690	101,000	.575	.64
July	2,690	399	839	51,600	.285	.33
August	420	315	385	23,700	.131	.15
September	315	236	302	18,000	.103	.11
October	275	217	235	14,400	.080	.09
November (1–26)	217	131	183	9,440	.062	.06
The period				468,000		
1906.[e]						
April[f]	1,220	193	479	28,500	.163	.18
May	231	175	193	11,900	.066	.08
June	340	193	271	16,100	.092	.10
July	270	119	175	10,800	.060	.07
August	143	119	131	8,060	.045	.05
September	166	136	147	8,750	.050	.06
October	150	136	144	8,850	.049	.06
November (1–19)	136	82	111	4,180	.038	.03
The period				97,100		

[a] Monthly discharge values for 1905 published in Water-Supply Paper No. 171. Some are subject to considerable error, owing to doubtful gage heights.
[b] Revised since 1905 report.
[c] Values for 1904 are rated as follows: April, fair; May to August, excellent; September to November, good. Gage heights for September and October are doubtful; otherwise values for these months could be classed as excellent.
[d] Discharge estimated for ice period April 8 to 20.
[e] Values for 1906 are probably good. Some months might be classed as excellent, but the observer's records for June at least do not appear to be good.
[f] Discharge not corrected for ice conditions April 1 to 7.

MISCELLANEOUS MEASUREMENTS IN RED RIVER DRAINAGE BASIN.

The following miscellaneous measurements were made in 1906 at the mouth of Red Lake River at East Grand Forks, Minn:

March 23: Area of section, 627 square feet; discharge, 853 second-feet; ice 2 feet thick.

August 11: Area of section, 1,000 square feet; discharge, 1,150 second-feet.

MOUSE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The Mouse (or Souris) River rises in the southeastern part of the Province of Assiniboia, Canada, and flows southeastward to the western part of McHenry County, N. Dak., thence northeastward for about 30 miles to Towner, N. Dak., where it makes another turn to the north and northwest, which carries it back into Canada, to empty into Assiniboine River, a tributary of Red River. Its drainage basin, which is limited on the southwest by the Missouri Coteau and on the northeast by the Turtle Mountains, is relatively large, but its flow is small. The region through which it flows is generally gently rolling,

except in the immediate vicinity of the stream, where the hills are steep and high. The chief tributary of the Mouse above Minot is Des Lacs River.

The data collected in this basin are valuable for irrigat'on purposes.

MOUSE RIVER NEAR FOXHOLM, N. DAK.

This station was established June 22, 1904, and was discontinued July 31, 1906. It is located at the highway bridge 3½ miles northeast of Foxholm, N. Dak., a station on the Minneapol's, St. Paul and Sault Ste. Marie Railway. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 42, where are given also references to publications that contain data for previous years.

Discharge measurements of Mouse River near Foxholm, N. Dak., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
September 16	E. F. Chandler	31	7.4	1.50	[a] 4.9
1906.					
April 24	E. F. Chandler	61	203	2.92	215
June 28	do	65	241	3.40	310

[a] Wading section

Daily gage height, in feet, of Mouse River near Foxholm, N. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Day.	Mar.	Apr.	May.	June.	July.
1		3.4	2.5	2.7	3.3	17		3.9	2.3	4.3	2.7
2		4.0	2.5	2.7	3.3	18		3.5	2.2	4.2	2.7
3		5.0	2.5	2.6	3.3	19		3.4	2.1	4.0	2.6
4		6.1	2.5	2.5	3.2	20		3.0	2.2	3.9	2.5
5		7.8	2.4	2.5	3.3	21		3.2	2.2	3.9	2.5
6		8.0	2.4	2.8	3.4	22		3.0	2.2	3.9	2.5
7		8.6	2.4	3.0	3.45	23		3.0	2.2	3.9	2.4
8		8.9	2.4	3.0	3.4	24		2.9	2.2	3.9	2.4
9		8.0	2.5	3.0	3.3	25		3.0	2.2	3.8	2.3
10		7.8	2.5	3.3	3.3	26	3.1	2.9	2.2	3.7	2.3
11		6.8	2.4	3.6	3.2	27		2.8	2.2	3.5	2.2
12		6.5	2.4	3.9	3.1	28		2.7	2.2	3.4	2.2
13		5.6	2.4	4.7	2.9	29		2.6	2.2	3.3	2.1
14		4.8	2.4	5.0	2.9	30		2.6	2.3	3.2	2.1
15		4.0	2.5	5.0	2.8	31	3.9		2.5		2.0
16		3.9	2.3	4.7	2.7						

NOTE.—Ice conditions January 1 to March 31.

MOUSE RIVER AT MINOT, N. DAK.

This station was established May 5, 1903. It is located at the footbridge 150 feet northwest of the Great Northern Railway roundhouse at Minot, N. Dak. The gage was read during 1906 by James

Cavanaugh. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 45, where are given also references to publications that contain data for previous years.

Discharge measurements of Mouse River at Minot, N. Dak., in 1904–1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1904.					
June 22	E. F. Chandler	88	400	6.69	668
June 24	do	87	373	6.32	577
July 13	R. Richards	83	291	5.16	279
July 14	do	83	299	5.29	312
August 12	do	77	220	4.40	102
September 18	E. F. Chandler	74	220	4.30	98
1905.					
March 27	Chandler and Richards	76	227	4.40	114
April 27	E. F. Chandler	70	195	4.03	44
May 24	do	77	223	4.56	139
May 24	do	54	89	4.45	a 122
August 18	R. Richards	48	58	4.01	a 30
September 17	E. F. Chandler	40	23	3.86	a 14
1906.					
April 23	E. F. Chandler	80	279	5.19	300
May 29	do	76	218	4.42	112
June 29	do	82	297	5.33	345
September 6	do	50	57	4.00	a 31
September 6	do	38	39	4.00	a 31

a Wading section.

Daily gage height, in feet, of Mouse River at Minot, N. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		5.0	4.9	5.4	5.2	4.5	4.0	3.8	3.9
2		5.2	4.9	5.5	5.2	4.4	4.0	3.8	3.9
3		5.4	4.8	5.5	5.2	4.4	4.0	3.8	3.9
4		5.0	4.8	5.3	5.2	4.4	4.0	3.8	3.9
5		5.2	4.8	5.2	5.1	4.4	4.0	3.8	3.9
6		5.4	4.8	5.9	5.1	4.4	4.0	3.8	3.9
7		5.7	4.8	5.9	5.1	4.3	4.0	3.9	3.9
8		6.5	4.8	5.8	5.1	4.3	4.0	3.9	3.9
9		8.0	4.7	5.8	5.1	4.3	4.0	3.9	3.9
10		9.4	4.7	5.8	5.0	4.3	4.0	3.9	3.9
11		9.2	4.7	5.8	5.0	4.3	4.0	3.9	3.9
12		8.4	4.7	5.9	5.0	4.2	4.0	3.9	3.9
13		7.3	4.7	5.9	5.0	4.2	4.0	3.9	3.9
14		5.7	4.6	6.0	5.0	4.2	4.0	3.9	3.9
15		5.7	4.6	6.1	5.0	4.1	4.0	3.9	3.9
16		5.7	4.6	6.1	4.9	4.1	4.0	3.9	3.9
17		5.7	4.6	6.0	4.9	4.1	4.0	3.9	3.9
18		5.6	4.6	5.9	4.8	4.1	4.0	3.9	3.9
19		5.6	4.6	5.8	4.7	4.1	4.0	3.9	.....
20		5.4	4.6	5.8	4.7	4.1	3.9	3.9	.....
21		5.4	4.5	5.8	4.6	4.0	3.9	3.9	.....
22		5.4	4.5	5.7	4.8	4.0	3.9	3.9	.....
23		5.3	4.5	5.6	4.8	4.0	3.9	3.9	.....
24		5.2	4.4	5.6	4.7	4.0	3.9	3.9	.....
25		5.2	4.4	5.5	4.7	4.0	3.9	3.9	.....
26		5.1	4.4	5.5	4.6	4.0	3.9	3.9	.....
27		5.1	4.4	5.4	4.6	4.0	3.9	3.9	.....
28		5.0	4.4	5.4	4.6	4.0	3.9	3.9	.....
29	4.0	5.0	4.4	5.4	4.6	4.0	3.9	3.9	.....
30	4.4	5.0	4.6	5.4	4.5	4.0	3.9	3.9	.....
31	4.8	.....	4.8	.....	4.5	4.0	.....	3.9	.....

NOTE.—Ice conditions January 1 to April 5; also November 18 to December 31.

Rating tables for Mouse River at Minot, N. Dak.

JANUARY 1, 1904, TO DECEMBER 31, 1905.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.80	10	4.00	33	4.20	68	4.40	108
3.90	20	4.10	50	4.30	87	4.50	130

JANUARY 1 TO DECEMBER 31, 1906.[b]

3.90	18	5.00	240	6.10	499	7.40	820
4.00	31	5.10	263	6.20	523	7.60	870
4.10	46	5.20	286	6.30	547	7.80	920
4.20	66	5.30	309	6.40	571	8.00	970
4.30	87	5.40	332	6.50	595	8.20	1,020
4.40	108	5.50	355	6.60	620	8.40	1,070
4.50	130	5.60	379	6.70	645	8.60	1,120
4.60	152	5.70	403	6.80	670	8.80	1,170
4.70	174	5.80	427	6.90	695	9.00	1,220
4.80	196	5.90	451	7.00	720	9.20	1,270
4.90	218	6.00	475	7.20	770	9.40	1,320

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904 and 1905. Prior to about June 20, 1904, the conditions of flow were not the same as they were after that date and any rating would be very uncertain. It is well defined between gage heights 3.85 feet and 6 feet. Above gage height 4.5 feet the table for 1906 should be used.

[b] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906. It is not well defined above 6 feet, but is well defined below this point.

Monthly discharge of Mouse River at Minot, N. Dak., for 1904 to 1906.

[Drainage area, 8,400 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
1904.[a]						
July	427	152	258	15,900	0.031	0.04
August	152	108	114	7,010	.014	.02
September	108	68	81.7	4,860	.0097	.01
October	87	68	71.8	4,410	.0085	.01
November 1-25	87	50	64.3	3,190	.0077	.01
The period				35,400		
1905.[b]						
March 5-31	108	78	97.6	5,230	0.012	0.01
April	78	33	61.2	3,640	.0073	.01
May	130	33	64.1	3,940	.0076	.01
June	119	68	98.6	5,870	.012	.01
July	108	59	81.3	5,000	.0097	.01
August	108	33	68.4	4,210	.0081	.01
September	87	10	30.3	1,800	.0036	.004
October	20	10	15.5	953	.0018	.002
November 1-28	33	20	24.6	1,370	.0029	.003
The period				32,000		
1906.[c]						
April	1,320	240	454	27,000	0.054	0.06
May	218	108	159	9,780	.019	.02
June	499	286	401	23,900	.048	.05
July	286	130	214	13,200	.025	.03
August	130	31	61.9	3,810	.0074	.01
September	31	18	26.2	1,560	.0031	.003
October	18	8	16.1	990	.0019	.002
November 1-18	18	18	18.0	643	.0021	.001
The period				80,900		

[a] Gage heights for 1904 have been published in Water-Supply Paper No. 130. Discharge values for 1904 are excellent. During the spring flood the maximum discharge was estimated to be 12,000 second-feet. Discharge values for stages greater than about 10 feet are very uncertain, owing to the collection of débris below the section causing back water.

[b] Estimates of monthly discharge for 1905 have been revised; gage heights for 1905 are published in Water-Supply Paper No. 171. Discharge values for 1905 are rated as follows: March to August, excellent; September to November, fair.

[c] Discharge values for 1906 are rated as follows: April and September, good; May to August, excellent; October and November, fair.

DES LACS RIVER AT FOXHOLM, N. DAK.

This station was established June 23, 1904, and was discontinued July 31, 1906. It is located at the highway bridge at Foxholm, N. Dak., a station of the Minneapolis, St. Paul and Sault Ste. Marie Railway. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 47, where are given also references to publications that contain data for previous years.

Discharge measurements of Des Lacs River at Foxholm, N. Dak., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
September 16	E. F. Chandler		3	1.96	[a] 1.6
1906.					
April 24	E. F. Chandler	17	8.3	2.36	[a] 6.6
Do	do	17	22	2.36	6.6
June 28	do	16	6.9	2.31	[a] 5.9

[a] Wading section.

Daily gage height, in feet, of Des Lacs River at Foxholm, N. Dak., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	2.0			8.4	2.35	3.4	2.0
2				8.0	2.35	3.0	2.0
3		2.0	2.4	7.9	2.3	3.0	1.9
4				7.6	2.3	3.0	1.9
5				5.0	2.3	3.7	1.9
6				4.7	2.3	3.8	1.9
7				3.7	2.25	3.8	1.9
8				3.7	2.25	3.8	1.9
9				3.6	2.0	3.7	1.8
10			3.0	3.55	2.0	3.7	1.8
11				3.4	2.0	3.65	1.8
12				3.2	2.0	3.5	1.8
13				3.0	2.0	3.3	1.8
14				2.8	2.1	3.0	1.8
15				2.7	2.2	2.8	1.8
16				2.65	2.2	2.8	1.8
17				2.6	2.25	2.8	1.8
18				2.6	2.25	2.8	1.8
19				2.5	2.25	2.7	1.8
20				2.45	2.25	2.7	1.8
21				2.45	2.3	2.6	1.8
22				2.4	3.0	2.6	1.8
23				2.4	3.2	2.6	1.8
24		2.0		2.4	3.3	2.5	1.8
25			3.0	2.35	3.5	2.4	1.8
26			3.0	2.35	3.6	2.4	1.8
27	2.0		4.0	2.35	3.6	2.3	1.8
28			5.3	2.4	3.7	2.0	1.8
29			6.0	2.4	3.7	2.0	1.8
30			7.0	2.35	3.7	2.0	1.8
31			7.5		3.5		1.8

NOTE.—Ice conditions January 1 to March 24; gage heights were probably to water surface in hole in ice; average thickness of ice, 1.1 feet.

Rating table for Des Lacs River at Foxholm, N. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	0.9	2.60	11	3.40	29	5.00	92
1.90	1.5	2.70	13	3.50	32	5.50	119
2.00	2.4	2.80	15	3.60	35	6.00	149
2.10	3.6	2.90	17	3.70	38	6.50	183
2.20	4.9	3.00	19	3.80	41	7.00	222
2.30	6.3	3.10	21	3.90	44	7.50	265
2.40	7.8	3.20	23	4.00	47	8.00	313
2.50	9.3	3.30	26	4.50	68		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906. It is fairly well defined up to gage height 4 feet; above that point the table is not well defined.

Monthly discharge of Des Lacs River at Foxholm, N. Dak., for 1906.

[Drainage area 615 square miles.]

Month	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March (25–31)	265	19	118	1,640	0.192	0.05
April	355	7.0	59.6	3,550	.097	.11
May	38	2.4	13.6	836	.022	.03
June	41	2.4	19.8	1,180	.032	.04
July	2.4	0.9	1.1	68	.0018	.002
The period				7,270		

NOTE.—Values are rated as follows: March and July, fair; April to June, good.

UPPER MISSISSIPPI RIVER DRAINAGE.

GENERAL FEATURES.

The sources of Mississippi River proper lie between latitudes 47° and 48° north, almost exactly in the center of the continent on an east-west line; its mouth is in latitude 29° north.

The basin, which is very irregular in outline, can best be described as an oblong with the major axis, 1,700 miles in length, running southeastward from the northwestern part of Montana, through North Dakota, Nebraska, Missouri, and Tennessee, into the northwestern corner of Alabama. On each side of this line the basin spreads out from 300 to 500 miles, while on the east there is a large protuberance from the general outline extending to the Allegheny Mountains. The eastern outline conforms roughly to that of the Atlantic coast, the mean distance between them being about 250 miles; the eastern and western outlines are determined by the two great mountain systems of the continent, the Appalachian and the Cordilleran. The total area drained is 1,240,000 square miles. It includes wholly or in part thirty States, besides a small area in the Dominion of Canada.

Topographically the country included within the Mississippi basin presents all varieties of form—mountain, prairie, arid plain, and alluvial bottom land teeming with vegetation, all are represented.

The drainage system may be divided into four grand sections, in the following order of size: (1) The Missouri basin, (2) the basins of Arkansas and Red rivers, (3) the Ohio basin, and (4) the basin of the upper Mississippi. The area last named, which is considered in this report, extends from the source of the river to the mouth of the Missouri; below that the stream is called the lower Mississippi.

In the northern part of Minnesota, 2,555 miles from the Gulf of Mexico, is a low plain consisting of sandy ridges of glacial origin, known as the Hauteur des Terres. It is a region of innumerable lakes, from one of the smallest of which, Lake Hernando de Soto, springs the great river. Lake Hernando de Soto is drained by a small stream flowing into Itasca Lake, which was for many years considered the source of the river. The length of Itasca Lake is about 4 miles and its breadth nowhere exceeds one-half mile. Its outlet is from 10 to 12 feet wide and from 12 to 18 inches deep.

From its utmost source to the falls of Pokegama the river flows through a drift-covered region in a valley, which is in some places narrow, in others broad and savanna-like, with many rapids in the narrower and with gentle or sluggish currents in the broader portions. In this part of its course it drains a number of lakes, among which Bemidji, Cass, Winnibigoshish, and Leech lakes are the most important. The total fall from the head of the stream to the mouth of Leech Lake River, which is nearly as large as the main stream, is about 420 feet. The first rock in place is at Pokegama Falls, and thence to the mouth of Crow Wing River, which enters from the west, the average width of the stream is 300 feet; the valley is less winding, and the current is good, with many rapids of small extent. The mouth of Crow Wing River is only 75 miles in a straight line from Lake Itasca, but the distance along the river course is 450 miles.

Below the mouth of the Crow Wing the river flows in a general southerly direction for about 475 miles. Within this stretch are several rapids, the chief being Little Falls and Sauk Rapids, and many timbered islands. The banks are abrupt, of clay or sandy loam, and lead to meadows that stand 60 feet above the river. At the falls of St. Anthony the river pitches down a vertical fall and rapid amounting to 75 feet in half a mile, and in so doing leaves the prairie and clay banks for a channel that lies between rocky bluffs of limestone and sandstone, which continue for many miles down the river, gradually increasing to a height of 500 feet as the bed sinks below the general prairie level. The sides of the bluffs are not vertical, bare surfaces of rock, but are composed of easily eroded stone and drift, which form well-wooded or grassy slopes.

Minnesota River, formerly called St. Peters River, enters the Mississippi about 10 miles below St. Anthony Falls, and below its mouth the breadth of the main stream averages 1,000 feet. From this point to the mouth of the Missouri the general characteristics of the river are the same—a broad placid stream with innumerable islands, the entire width of the valley averaging 1 mile. In many places, especially where tributaries enter, there are fertile flats between the river and the bluffs. Fifty-five miles below the mouth of the Minnesota is Lake Pepin, an expansion of the river apparently caused by the immense quantities of sand brought down by the Chippewa.

At two places exceptions occur to the otherwise placid character of the river. At Rock Island, Ill., 384 miles from St. Paul, there are rapids by which the river falls 20.4 feet in 12 miles, and at Keokuk, Iowa, 509 miles from St. Paul, is the foot of the Des Moines Rapids, where in a distance of 11 miles the river falls 21.85 feet.

The large tributaries below the Minnesota are the St. Croix, Chippewa, Wisconsin, Rock, and Illinois from the east and the Iowa and Des Moines from the west.

MISSISSIPPI RIVER PROPER.

MISSISSIPPI RIVER NEAR SAUK RAPIDS, MINN.

This station was established April 23, 1903, and was discontinued March 31, 1906, owing to the construction of a dam 2 miles below. It is located about 1½ miles south of Watab station, on the Northern Pacific Railway, about 5 miles north of Sauk Rapids and 7 miles north of St. Cloud. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 51, where are given also references to publications that contain data for previous years.

Discharge measurements of Mississippi River near Sauk Rapids, Minn., in 1903–1905.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1903.					
August 4	W. R. Hoag	580	4,080	13.22	7,910
September 9	E. C. Murphy	615	3,350	11.85	5,020
Do	Murphy and Stockman	615	3,340	11.85	5,040
October 17	L. R. Stockman	631	5,680	15.60	17,400
1904.					
January 5	E. Johnson jr	515	2,200	[a] 11.55	2,470
April 20	E. F. Chandler	585	4,170	14.26	12,300
July 1	do	577	3,790	13.31	8,020
July 25	R. Richards	557	2,680	11.38	4,740
August 22	do	572	3,400	12.76	[b] 4,340
September 8	do	561	2,860	11.77	[c] 4,800
October 15	E. F. Chandler	578	3,820	13.75	9,350
1905.					
January 3	R. Richards	[d] 560	1,810	[d] 11.29	2,620
April 5	do	582	3,890	13.60	8,520
December 26	do	580	3,690	12.88	6,800

[a] Ice 1.7 feet thick, and anchor ice. Gage height to bottom of ice, 10.20 feet.
[b] Log jam 600 feet below.
[c] Partial log jam 600 feet below.
[d] Ice 1.5 feet thick. Gage height to bottom of ice, 9.9 feet.

Daily gage height, in feet, of Mississippi River near Sauk Rapids, Minn., for 1906.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
3		12.95	13.25	20	12.95		
8	12.9			24		13.35	12.75
10		12.95	13.15	25		13.35	
14	12.95			27	12.95		
17		13.0	12.85	31			13.5
18		13.0					

NOTE. No ice notes given by observer; ice conditions not known. The river, however, was known to be open December 26, 1905.

Rating table for Mississippi River near Sauk Rapids, Minn., for 1903–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
10.80	3,480	12.10	5,450	13.40	8,310	15.40	16,370
10.90	3,610	12.20	5,640	13.50	8,590	15.60	17,440
11.00	3,740	12.30	5,830	13.60	8,880	15.80	18,550
11.10	3,880	12.40	6,020	13.70	9,180	16.00	19,700
11.20	4,020	12.50	6,220	13.80	9,490	16.20	20,890
11.30	4,160	12.60	6,420	13.90	9,810	16.40	22,120
11.40	4,300	12.70	6,630	14.00	10,150	16.60	23,390
11.50	4,450	12.80	6,840	14.20	10,870	16.80	24,700
11.60	4,600	12.90	7,060	14.40	11,660	17.00	26,050
11.70	4,760	13.00	7,290	14.60	12,510	18.00	33,200
11.80	4,920	13.10	7,530	14.80	13,400	19.00	40,990
11.90	5,090	13.20	7,780	15.00	14,350	20.00	49,290
12.00	5,270	13.30	8,040	15.20	15,340		

NOTE. The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1905. It is well defined between gage heights 11.5 feet and 16.0 feet.

Monthly discharge of Mississippi River near Sauk Rapids, Minn., for 1903–1905.[a]

[Drainage area, 12,400 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1903.[b]					
May 3–31	21,200	10,200	13,600	1.10	1.19
June	9,650	4,300	5,750	.464	.52
July	8,450	4,230	6,090	.491	.57
August	7,830	4,450	6,000	.484	.56
September	18,300	4,520	10,300	.831	.93
October	27,100	7,290	16,000	1.29	1.49
November 1–14; 27–30[c]	9,840	5,360	6,720	.542	.36
December			3,740	.302	.35
1904.[d]					
January			2,340	.189	.22
February			2,070	.167	.18
March			2,620	.211	.24
April 11–30[e]	19,100	10,300	12,600	1.02	.76
May	12,500	7,660	10,400	.839	.97
June	13,200	5,540	8,700	.702	.78
July	8,040	3,950	5,910	.477	.55

[a] It is possible that log jams below this station may have affected results over relatively short periods. Ice estimates are based on the observer's notes on ice statements and on two measurements made under ice conditions.

[b] Gage heights for 1903 have been published in Water-Supply Paper No. 98. Discharge values are rated as follows: May to July, good; August to November, excellent; remainder of the year, approximate. Ice conditions December 1 to 31.

[c] No gage-height records November 15 to 26.

[d] Gage heights for 1904 have been published in Water-Supply Paper No. 128. Discharge values for 1904 are rated as follows: April to November, excellent; remainder of the year, approximate. Ice conditions as follows: January 1 to April 10, December 1 to December 31.

[e] Ice gorge April 1 to 10.

Monthly discharge of Mississippi River near Sauk Rapids, Minn., for 1905—Cont'd.

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. miles.	Depth in inches.
1904.					
August[a]	5,000	3,680	4,240	0.342	0.39
September[a]	5,640	4,020	4,570	.369	.41
October	10,300	5,270	8,280	.668	.77
November	7,290	3,740	5,400	.435	.49
December	.....	.....	3,050	.246	.28
1905.[b]					
January	.....	.....	2,620	.211	.24
February	.....	.....	2,500	.202	.21
March	4,680	.....	3,180	.256	.30
April	11,300	4,020	6,570	.530	.59
May	22,800	4,380	14,000	1.13	1.30
June	35,500	7,530	21,000	1.69	1.89
July	51,000	10,900	28,700	2.31	2.66
August	15,800	9,980	12,900	1.04	1.20
September	10,900	7,000	9,320	.752	.84
October	7,660	5,270	6,700	.540	.62
November	7,290	5,270	6,000	.484	.54
December	.....	.....	7,190	.580	.67
The year	51,000	.....	10,100	.810	11.06

[a] Log jam August 20 to September 3; discharge values corrected.
[b] Gage heights for 1905 have been published in Water-Supply Paper No. 171. Discharge values are rated as follows: May to November, excellent; April, fair; remainder of the year, approximate. Ice conditions as follows: January 1 to March 29, December 1 to 31.

MISSISSIPPI RIVER AT ANOKA, MINN.

This station was established May 8, 1905. It is located at a highway bridge three-fourths mile southwest of Anoka. The station was temporarily discontinued from July 20, 1906, to August 10, 1906. The bench mark is a chiseled cross on the face of the stone in the lower wing wall of the left abutment of the bridge, the second stone of the bottom course. The mark is about 5 feet from the lower end of the wing wall; elevation, 11.19 feet above the gage datum. The conditions at this station are described in Water-Supply Paper No. 171, page 52.

Discharge measurements of Mississippi River at Anoka, Minn., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
September 16	R. Richards	764	4,600	2.36	12,200
November 3	E. F. Chandler	756	4,000	1.77	9,650
December 27	R. Richards	755	3,700	2.86	[a] 7,910
1906.					
April 12	Horton and Brennan	776	6,740	5.20	24,000
May 25	M. S. Brennan	781	6,250	4.50	22,200

[a] Ice measurement made at section 600 feet below bridge. Lower surface of ice at gage height, 1.90 feet; average thickness of ice, 1.06 feet.

Daily gage height, in feet, of Mississippi River at Anoka, Minn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1				2.3	4.25	6.0	4.8		2.8	3.5		6.3
2				2.4	4.25	5.8	4.85		2.8	3.35		9.4
3			2.0	3.4	4.25	5.6	5.05		2.8	3.35		10.4
4		2.3		5.4	4.25	6.0	5.0		2.8	3.2		10.0
5	2.3			5.5	3.8	6.0	5.05		2.7	3.0		9.5
6				4.5	3.8	6.45	4.9		2.65	3.0		9.5
7				5.6	3.8	6.8	4.85		2.65	2.8	2.8	9.3
8				6.0	3.8	7.0	5.0		2.6	2.8	2.8	9.3
9				5.5	3.8	7.2	5.0		2.3	2.6	2.75	
10		2.5		5.4	4.0	7.35	4.8	1.5	2.0	2.3	2.7	
11			2.4	5.5	4.2	7.25	4.8	1.5	1.5	2.3	2.7	
12				5.3	4.25	7.2	4.25	1.5	1.5	2.2	2.7	
13	2.1			5.3	4.2	6.8	4.2	1.55	1.5	2.2	2.6	
14				5.4	4.2	6.5	4.0	1.65	1.5	2.2	2.5	
15				5.8	3.8	6.1	3.8	1.8	1.8	1.8	2.4	6.8
16				5.97	3.4	5.6	3.55	1.8	1.8	1.8	2.4	
17				5.97	3.4	5.15	3.5	1.8	1.8	1.8	2.35	
18			2.75	5.85	3.25	4.9	3.0	1.8	1.8	1.95	2.1	
19		2.3		5.8	3.2	4.85	2.8	1.8	1.85	2.0	1.9	
20				5.6	3.4	4.85	2.55	1.85	1.85	2.0	2.8	
21				5.4	3.5	4.5		1.85	1.9	2.05	3.8	
22	2.2			5.4	3.55	4.5		1.85	2.0	1.9	6.1	6.2
23				5.1		4.8		1.85	2.0	1.8	6.9	
24		2.3	2.7	4.8		4.8		1.85	2.35	1.8	7.6	
25				4.25	4.5	4.7		1.85	2.5	1.8	8.8	
26				4.25		4.55		2.0	2.8	2.3	5.3	
27	2.2			4.25	4.5	4.55		2.1	2.85	2.5	3.3	
28				4.3	5.4	4.8		2.5	3.0	2.8	2.8	
29				4.8	6.0	4.85		2.6	3.0	3.0	2.8	5.4
30				4.25	6.0	4.85		2.8	3.0		3.5	
31					6.0			2.8				

NOTE.--The river was frozen from January 1 to March 31; gage heights are to water surface in a hole in the ice, except during February, when the river at the gage was frozen to the bottom, and gage heights are to top of ice. The following comparative readings were taken:

Comparative ice and water gage heights of Mississippi River at Anoka, Minn.

Date.	Water surface.	Top of ice.	Thickness of ice at gage.
January 5	2.3	2.5	1.2
January 13	2.1	2.3	1.2
January 22	2.2	2.3	1.4
January 27	2.2	2.3	1.5
March 3	2.0	2.0	1.65
March 11	2.4	2.5	1.65
March 18	2.75	2.85	1.3
March 24	2.7	2.85	1.2

Ice conditions caused backwater November 20 to 26; also during the first part of December. River frozen entirely across December 15.

MISCELLANEOUS MEASUREMENT OF MISSISSIPPI RIVER.

The following miscellaneous measurement was made of the Mississippi River from the Chicago Great Western Railroad bridge at St. Paul, Minn.:

October 31, 1905: Width, 894 feet; area, 7,640 square feet; gage height, 5.54 feet; discharge, 16,100 second-feet.

CROW RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Crow River is formed by the junction of North and South forks. Below the junction the river is only 18 miles in length, while North and South forks are 96 and 80 miles long, respectively. With the exception of the Crow Wing this river is the largest tributary of the Mississippi above the Minnesota.

The basin of the Crow lies wholly within the State of Minnesota. It consists, principally, of rolling prairie, interspersed with groves of hard-wood timber, and is largely cultivated. The numerous lakes within its limits, some of which are 4 or 5 square miles in area, help to make the flow of the river uniform.

The stream is of value for water power, especially North Fork and the main stream below the junction.

CROW RIVER NEAR DAYTON, MINN.

This station was established April 13, 1906, and was discontinued July 21, 1906. It is located at the highway bridge at Berning's mill, about 13½ miles by road from Anoka, Minn., and about 7 miles up the valley from Dayton, at the mouth of the river.

The channel is straight for about 200 feet above and below the station. Berning's mill and dam are about 200 feet above the bridge. The mill uses only a small amount of the total flow. Water flows over the dam at all times. There is one channel at all stages. Both banks are of medium height and are but rarely or never overflowed. The bed of the stream is of coarse gravel and is permanent. The current is swift.

Discharge measurements are made from the lower side of the single-span highway bridge. The initial point for soundings is the inner face of the left cylinder pier.

The gage, which was read during 1906 by Joseph Berning, is a vertical staff attached to a pile near the left end of the bridge on the upstream side. The bench mark is a point between two chisel drafts on top of the casing of the upstream pier at the left end of the bridge. An arrow chiseled on the upstream side of the pier points toward the mark; elevation, 15.66 feet above the gage datum.

The high water of 1890, the highest for fifty years, corresponded to a gage height of 15.5 feet.

Discharge measurements of Crow River near Dayton, Minn., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
November 2	E. F. Chandler	160	509	3.79	570
1906.					
April 13	Horton and Brennan	168	907	6.53	2,010
May 26	M. S. Brennan	215	2,030	12.00	8,050

Daily gage height, in feet, of Crow River near Dayton, Minn., for 1906.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1	.....	5.4	13.8	8.0	17	7.5	6.0	9.4	6.2
2	.....	5.6	13.3	8.0	18	7.2	6.1	9.0	6.1
3	.....	5.8	12.8	7.9	19	7.0	6.1	8.7	6.0
4	.....	5.9	12.9	7.9	20	6.8	6.0	8.7	5.9
5	.....	5.8	12.5	7.9	21	6.6	6.9	8.8	5.7
6	.....	5.7	12.6	7.8	22	6.3	9.7	8.9	.....
7	.....	5.5	12.8	7.6	23	6.1	10.7	8.9	.....
8	.....	5.4	12.7	7.4	24	5.9	11.6	8.7	.....
9	.....	5.3	12.5	7.3	25	5.7	11.9	8.6	.....
10	.....	5.2	12.3	7.1	26	5.5	12.1	8.5	.....
11	.....	5.1	11.9	6.9	27	5.4	12.9	8.3	.....
12	.....	5.0	11.4	6.7	28	5.3	13.3	8.3	.....
13	6.5	5.4	10.9	6.5	29	5.3	13.6	8.3	.....
14	7.1	5.6	10.6	6.4	30	5.3	13.8	8.1	.....
15	7.7	5.8	10.1	6.3	31	.....	13.9	.....	.....
16	7.7	5.9	9.8	6.3					

Rating table for Crow River near Dayton, Minn., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.00	1,080	6.30	1,855	7.60	2,845	9.80	5,110
5.10	1,130	6.40	1,925	7.70	2,930	10.00	5,350
5.20	1,185	6.50	1,995	7.80	3,020	10.20	5,600
5.30	1,240	6.60	2,065	7.90	3,110	10.40	5,855
5.40	1,295	6.70	2,135	8.00	3,200	10.60	6,115
5.50	1,350	6.80	2,210	8.20	3,390	10.80	6,380
5.60	1,410	6.90	2,285	8.40	3,585	11.00	6,650
5.70	1,470	7.00	2,360	8.60	3,785	12.00	8,050
5.80	1,530	7.10	2,435	8.80	3,990	13.00	9,550
5.90	1,595	7.20	2,515	9.00	4,200	14.00	11,140
6.00	1,660	7.30	2,595	9.20	4,420		
6.10	1,725	7.40	2,675	9.40	4,645		
6.20	1,790	7.50	2,760	9.60	4,875		

NOTE.—The above table is based on three discharge measurements made during 1905–6. Its accuracy is wholly dependent on the accuracy of the three measurements which define it; an error in any one would involve a corresponding error in the rating at the stage of the measurement in question. The general form of the curve, however, appears to be very good.

Monthly discharge of Crow River near Dayton, Minn., for 1906.

[Drainage area, 2,540 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April 13-30	2,930	1,240	1,960	0.772	0.32
May	11,000	1,080	3,790	1.49	1.72
June	10,800	3,300	6,170	2.43	2.71
July 1-21	3,200	1,470	2,360	.929	.73

NOTE.—Values for 1906 are probably excellent. See rating table footnote.

RUM RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Rum River, so named on account of the color of its water, starts from the southwestern part of Mille Lacs, in east-central Minnesota, flows southward, and enters the east side of the Mississippi at Anoka,

7½ miles below the mouth of Crow River. Its basin is about 80 miles long and averages not over 19 miles in width. The large body of water at its head serves an important part in maintaining the flow during low water. The stream flows between banks of clay or mud, and where it crosses the ridge of granite which produces Sauk Rapids on the Mississippi there is a slight fall over rock in place.

Rum River has been largely used for lumbering, and its small tributaries have many dams, built for holding and flushing logs into the main river. The data collected in this basin are valuable for water-power purposes.

RUM RIVER NEAR ANOKA, MINN.

This station was established May 8, 1905, and was discontinued July 21, 1906. It is located at the highway bridge 6½ miles due north of Anoka, the distance by road being 7½ miles. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 54.

Discharge measurements of Rum River near Anoka, Minn., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
September 16	R. Richards	148	877	12.65	987
November 2	E. F. Chandler	149	939	13.16	1,190
December 28	R. Richards	145	488	13.26	[a] 765
1906.					
April 12	Horton and Brennan	200	1,950	17.66	4,480
May 26	M. S. Brennan	191	1,290	14.18	1,810

[a] Ice measurement; gage height to under side of ice 12.26 feet; ice about 1 foot thick. The discharge was about 60 per cent of the open-channel rating for gage height 13.26 feet.

Daily gage height, in feet, of Rum River near Anoka, Minn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1				15.2	13.8	16.2	13.9
2				15.3	13.6	16.45	14.0
3		13.25	13.85	15.4	13.4	16.3	13.9
4				15.6	13.65	15.95	13.8
5				15.9	13.8	15.9	13.65
6	13.1			16.6	13.8	15.6	13.5
7				17.55	13.7	15.7	13.0
8				18.0	13.85	16.15	13.0
9				18.45	13.75	16.95	12.9
10		13.15	13.75	18.55	13.7	18.98	12.8
11				18.2	13.45	20.45	12.75
12				17.9	13.4	21.3	12.75
13	13.25			17.5	13.7	21.15	12.7
14				17.6	14.0	20.15	12.7
15				17.6	13.9	19.0	12.65
16				17.5	13.7	18.25	12.6
17		13.25	13.65	17.4	13.65	16.85	12.65
18				17.35	13.6	16.25	12.6
19				17.45	13.45	15.5	12.5
20	13.1			17.4	13.4	14.6	12.45
21				17.1	13.5	13.85	12.4
22				16.8	13.8	13.7	
23				16.2	13.8	13.8	
24		13.45	13.4	15.5	13.8	13.75	
25				15.1	14.0	13.8	

Daily gage height, in feet, of Rum River near Anoka, Minn., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
26				14.5	14.2	13.95	
27	13.35			14.4	15.0	14.3	
28				14.15	15.45	14.5	
29				13.95	15.4	14.35	
30				13.9	15.6	13.85	
31			15.1		16.0		

NOTE.—The river was frozen January 1 to March 31; gage heights were to the water surface in a hole in the ice. The following comparative readings were taken:

Comparative water and ice gage heights on Rum River near Anoka, Minn.

Date.	Water surface.	Top of ice.	Thickness of ice.
January 6	13.1	13.15	1.[illegible]
January 13	13.25	13.35	1.2
January 20	13.1	13.2	1.2
January 27	13.35	13.4	1.4
February 3	13.25	13.3	1.4
February 10	13.15	13.2	1.5
February 17	13.25	13.3	[illegible]
February 24	13.45	13.5	[illegible]
March 3	13.85	13.9	1.5
March 10	13.75	13.8	1.4
March 17	13.65	13.7	1.5
March 24	13.4	13.5	1.6

Rating table for Rum River near Anoka, Minn., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
11.00	470	12.30	830	13.60	1,450	15.80	3,000
11.10	490	12.40	870	13.70	1,510	16.00	3,150
11.20	510	12.50	910	13.80	1,570	16.20	3,300
11.30	535	12.60	950	13.90	1,630	16.40	3,460
11.40	560	12.70	990	14.00	1,690	16.60	3,620
11.50	585	12.80	1,030	14.20	1,830	16.80	3,780
11.60	610	12.90	1,070	14.40	1,970	17.00	3,940
11.70	640	13.00	1,120	14.60	2,110	18.00	4,750
11.80	670	13.10	1,170	14.80	2,250	19.00	5,600
11.90	700	13.20	1,220	15.00	2,400	20.00	6,450
12.00	730	13.30	1,270	15.20	2,550	21.00	7,300
12.10	760	13.40	1,330	15.40	2,700	22.00	8,150
12.20	795	13.50	1,390	15.60	2,850		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1905-6. It is well defined between gage heights 11.7 feet and 14.5 feet. The table has been extended beyond these limits, being based on one measurement at gage height 17.66 feet.

Monthly discharge of Rum River near Anoka, Minn., for 1906.

[Drainage area, 1,430 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January			672	0.470	[illegible]
February			612	.428	[illegible]
March			786	.550	[illegible]
April	5,210	1,630	3,550	2.48	[illegible]
May	3,150	1,330	1,720	1.20	[illegible]
June	7,550	1,510	3,430	2.40	[illegible]
July 1-21	1,690	870	1,150	.804	[illegible]

NOTE.—Values are rated as follows: January to March, approximate; April to July, excellent. Flow under ice cover estimated.

MINNESOTA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Minnesota River rises in Bigstone Lake, which forms part of the boundary between South Dakota and Minnesota, flows southeastward to the city of Mankato, in the northern part of Blue Earth County, where it makes an abrupt turn to the north, and continues in a northerly and northeasterly direction until it enters the Mississippi at a point midway between Minneapolis and St. Paul. The course of this river is generally marked by wide bottom lands. It has a sluggish current, affording few opportunities for the development of water power.

MINNESOTA RIVER NEAR MANKATO, MINN.

This station was established May 20, 1903, and was discontinued July 21, 1906. It is located at Sibley Park, 1 mile below the highway and railroad bridges across Blue Earth River and 1½ miles above the city bridge in Mankato. Blue Earth River joins the Minnesota about 500 feet above the station. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 56, where are given also references to publications that contain data for previous years.

Discharge measurements of Minnesota River near Mankato, Minn., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
November 1	E. F. Chandler	298	815	2.69	1,240
December 29	R. Richards	297	811	3.70	[a] 1,070
1906.					
April 11	Horton and Brennan	310	1,890	7.59	6,020
May 24	M. S. Brennan	308	1,730	5.81	4,300

[a] Ice measurement; gage height to under side of ice, 3 feet; ice thickness, about 0.8 foot. The discharge was about 55 per cent of the discharge as given by the open-channel rating for gage height 3.70 feet.

Daily gage height, in feet, of Minnesota River near Mankato, Minn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	3.5	3.2	4.8	7.1	6.3	8.2	7.55
2	3.5	3.3	4.8	7.6	6.45	8.3	7.4
3	3.5	3.3	4.95	8.1	6.55	8.3	7.45
4	3.5	3.0	4.85	7.6	6.6	8.3	7.4
5	3.5	3.2	4.8	7.4	6.55	8.5	7.3
6	3.5	3.1	4.9	7.1	6.45	8.7	7.2
7	3.45	3.1	4.8	7.0	6.3	8.8	7.1
8	3.45	3.05	4.9	6.8	6.25	8.95	7.0
9	3.45	3.0	5.4	7.1	6.15	9.1	6.85
10	3.45	3.0	5.4	7.4	6.0	9.2	6.75
11	3.4	2.95	5.2	8.0	5.85	9.2	6.6
12	3.4	2.9	4.9	7.45	5.75	9.15	6.4
13	3.4	2.9	4.7	7.8	5.65	9.05	6.45
14	3.4	2.9	4.5	8.85	5.55	8.95	6.0
15	3.35	2.9	4.4	8.9	5.4	8.9	5.85

Daily gage height, in feet, of Minnesota River near Mankato, Minn., for 1906—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
16	3.4	2.9	4.15	9.2	5.3	8.8	5.6
17	3.4	2.9	3.95	9.3	5.3	8.7	5.4
18	3.4	2.9	3.6	9.25	5.5	8.55	5.3
19	3.35	2.9	3.6	9.1	5.55	8.65	5.15
20	3.35	3.1	3.6	8.85	5.55	8.6	5.0
21	3.35	3.2	3.3	8.6	5.35	8.45	4.8
22	3.35	3.4	3.3	8.3	5.75	8.4	.....
23	3.3	4.0	3.4	7.9	5.55	8.4	.....
24	3.25	4.45	3.1	7.5	5.7	8.3	.....
25	3.2	4.4	3.1	7.3	5.75	8.2	.....
26	3.05	4.4	3.25	7.05	5.8	8.1	.....
27	3.0	4.5	4.3	6.8	6.15	8.1	.....
28	3.0	4.6	4.25	6.55	6.55	8.1	.....
29	3.05	.....	4.65	6.45	7.0	8.1	.....
30	3.2	.....	5.1	6.3	7.6	8.1	.....
31	3.2	.....	5.45	.....	8.0	.....	.....

NOTE. Ice conditions January 1 to April 2.

Rating table for Minnesota River near Mankato, Minn., for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.80	3,090	5.80	4,270	6.80	5,610	7.80	7,010
4.90	3,200	5.90	4,400	6.90	5,750	7.90	7,150
5.00	3,310	6.00	4,530	7.00	5,890	8.00	7,300
5.10	3,430	6.10	4,660	7.10	6,030	8.20	7,600
5.20	3,550	6.20	4,790	7.20	6,170	8.40	7,900
5.30	3,670	6.30	4,920	7.30	6,310	8.60	8,200
5.40	3,790	6.40	5,050	7.40	6,450	8.80	8,500
5.50	3,910	6.50	5,190	7.50	6,590	9.00	8,800
5.60	4,030	6.60	5,330	7.60	6,730	9.20	9,100
5.70	4,150	6.70	5,470	7.70	6,870		

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1905 and 1906. It is well defined between gage heights 2.8 feet and 8.6 feet. On account of changes at gaging section, measurements of previous years were not applicable. For low stages this table gives over 25 per cent increase over the 1903 table.

Monthly discharge of Minnesota River near Mankato, Minn, for 1906.

[Drainage area, 13,400 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April	9,250	4,920	6,980	0.521	0.58
May	7,300	3,670	4,650	.347	.40
June	9,100	7,450	8,160	.609	.68
July 1-21	6,660	3,090	5,120	.382	.30

NOTE.—Values for 1906 are excellent.

CHIPPEWA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Chippewa River rises in the southeastern part of Ashland County, Wis., flows southwestward, and unites with the Mississippi near Wabash, Minn. Its principal tributary is Flambeau River, which enters from the east, in Gates County.

A. BRUNETT FALLS, CHIPPEWA RIVER, WISCONSIN.

B. LOWER PITCH OF BIG FALLS, FLAMBEAU RIVER, WISCONSIN.

The Chippewa is one of the most important power streams in Wisconsin. There are some 33 feet of fall at Chippewa Falls. Between the falls and the mouth of the Flambeau, 43 miles, there is a fall of 244 feet, 116 feet of this being concentrated in five falls and rapids. The large flow of the Chippewa and the use of storage reservoirs to maintain the summer flow gives the stream unusual value as a source of power.

One of the best powers on Chippewa River, and one most cheaply developed, is found at Brunett Falls (Pl. III, *A*), in sec. 18, T. 31 N., R. 6 W. It belongs to Cornell University, which also owns the adjacent land as well as the water rights. The best location for the dam would be about 650 feet above the foot of the rapids, where a 35-foot dam would create a large reservoir, backing the water up to the rapids at Holcombe, 5½ miles above. The river at the dam site is narrow (70 or 80 feet), while the banks are high granite ledges; the plans are said to contemplate a dam 200 feet long. A steel wagon bridge has recently been built across the river immediately below.

CHIPPEWA RIVER AT CHIPPEWA FALLS, WIS.

The United States Weather Bureau has maintained a station at this point since 1900. June 1, 1906, the Geological Survey began making discharge measurements at the highway bridge, 2,500 feet below the dam at Chippewa Falls.

The channel is straight for 500 feet above the station and for a considerable distance below. The left bank is low and liable to overflow; the right bank is formed by a railroad embankment, which is under water in high floods. The bed of the stream is gravel and sand and is probably permanent. The current is swift.

Discharge measurements are made from the lower side of the steel highway bridge. The initial point for soundings is the inner face of the right abutment at the downstream side.

The gage is an iron staff attached to the downstream face of the first pier from the right bank. The gage readings for 1906 were furnished by N. O. Swift, the United States Weather Bureau observer at Chippewa Falls.

The river stage during the "sawing season" fluctuates very rapidly at times, due to the storage of water at Holcombe by the lumber company. This reservoir is opened two or three times a week to flood logs to the sawmill.

A measurement was made at this station on June 1, 1906, by M. S. Brennan, giving the following results:

Width, 721 feet; area, 4,700 square feet; gage height, 6.70 feet; discharge, 18,000 second-feet.

Daily gage height, in feet, of Chippewa River at Chippewa Falls, Wis., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		5.0	4.0	8.2	2.0	1.7	2.3	1.5	3.9	3.0
2		4.3	4.0	2.3	1.8	1.5	1.4	1.8	3.6	2.7
3		5.5	4.2	5.0	2.4	1.0	1.5	3.0	3.4	2.4
4		6.3	4.4	4.0	2.3	1.4	4.6	1.8	3.2	2.2
5		8.0	5.0	3.1	2.0	1.3	1.8	1.5	3.1	2.0
6		7.9	5.1	3.6	2.4	1.5	1.5	1.3	3.0	1.9
7		7.8	5.4	3.1	2.3	3.0	1.8	1.2	3.0	1.8
8		8.0	4.5	5.1	1.0	1.9	1.5	1.0	3.0	1.8
9		9.0	2.5	6.0	1.5	2.3	1.4	1.2	3.8	1.8
10		9.8	2.3	5.6	2.0	2.4	2.4	1.2	3.8	1.8
11		9.9	2.0	5.1	2.3	1.5	1.5	3.3	3.6	1.8
12		9.5	1.8	5.0	1.5	1.3	1.6	1.3	3.4	1.9
13		9.6	2.3	4.0	1.6	1.9	1.7	1.3	3.3	2.0
14		10.0	2.9	3.9	1.5	1.2	1.8	1.4	3.2	2.0
15		11.5	5.8	3.5	2.0	1.7	3.0	1.5	2.[illegible]	2.0
16		11.4	5.0	3.3	2.4	1.4	3.2	1.7	2.6	2.0
17		10.5	2.3	2.3	2.7	1.3	6.5	1.8	2.5	2.0
18		9.3	4.3	3.5	1.8	1.4	3.6	1.8	2.8	2.0
19		8.8	4.4	1.8	2.0	1.3	2.6	1.5	3.3	2.0
20		7.4	2.9	1.5	1.9	1.2	2.8	1.5	3.0	2.0
21		8.0	3.0	1.9	1.7	1.5	2.5	1.7	2.8	2.0
22		7.8	1.8	2.0	1.1	1.8	2.8	2.0	2.7	2.0
23		7.4	4.0	2.4	1.3	4.0	3.0	2.3	2.5	2.0
24		7.0	5.7	1.0	1.0	1.8	6.8	2.4	2.2	2.0
25		7.3	2.4	1.5	1.8	4.5	3.8	3.0	2.0	2.0
26		6.3	3.8	2.5	1.5	2.8	3.5	5.1	2.2	2.0
27		5.6	5.5	2.7	1.6	4.2	2.5	5.0	2.5	2.0
28		5.0	6.6	2.8	1.5	1.8	2.3	5.0	3.0	2.0
29		4.4	6.8	3.3	1.2	2.7	2.5	4.9	3.3	2.0
30		4.2	5.9	1.0	1.0	1.5	2.4	4.6	3.4	2.0
31	3.6	.....	5.7	.....	1.5	1.3	.....	3.8	.....	2.0

NOTE.—There were ice conditions January 1 to March 31; also December 13 to 31.

CHIPPEWA RIVER NEAR EAU CLAIRE, WIS.

This station was established November 13, 1902. It is located 2 miles below Eau Claire, at a suburb known as Shawtown. The river stage during the "sawing season" fluctuates very rapidly at times, owing to the lumber company at Chippewa Falls storing water about 30 miles above the falls in a reservoir which is opened two or three times a week to flood logs to the sawmill. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 59, where are given also references to publications that contain data for previous years.

Discharge measurements of Chippewa River near Eau Claire, Wis., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 25	M. S. Brennan	332	2,770	4.82	[a] 2,760
April 25	do	425	4,870	9.45	17,100
June 2	do	355	3,650	6.52	7,980

[a] Ice measurement; river partly open. Gage height to bottom of ice, 3.92 feet; ice 1 to 1.2 feet thick. Discharge was about 75 per cent of the open-channel rating for gage height, 4.82 feet.

Daily gage height, in feet, of Chippewa River near Eau Claire, Wis., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.62	4.91	5.73	8.38	7.66	10.30	5.88	5.72	8.95	5.32	7.29	6.91
2				9.57	7.58	6.22	8.44	5.06	4.76	5.28	7.04	6.36
3				10.90	7.79	9.00	6.64	4.30	5.23	6.60	7.19	5.81
4				12.27	8.30	7.13	6.12	4.34	9.55	5.40	6.99	6.02
5		4.95	5.45	13.48	8.76	6.20	5.42	3.52	5.82	5.18	6.74	6.04
6				12.46	8.52	7.18	5.76	4.29	4.83	4.85	6.57	5.56
7				12.25	9.00	6.80	7.52	7.92	5.36	4.26	6.55	5.25
8			5.15	12.35	9.00	9.65	4.35	5.51	4.98	4.24	6.76	5.08
9		5.05		12.90	6.78	9.82	5.20	5.27	4.48	4.52	6.78	5.07
10				13.55	7.16	9.24	5.22	7.87	6.25	4.36	7.20	4.86
11				13.50	7.44	8.00	6.18	5.52	5.35	6.40	6.80	5.28
12		5.19	5.21	12.99	6.86	8.92	5.32	3.68	4.79	5.34	6.92	5.34
13				12.95	6.60	7.58	4.98	6.62	4.82	5.04	6.65	5.56
14	4.25			13.73	10.06	7.50	5.13	5.05	5.04	3.55	6.54	5.46
15		5.00	4.96	14.86	10.26	6.84	5.25	4.62	6.12	4.82	5.95	5.75
16				14.71	8.77	6.74	5.58	4.51	6.50	4.90	6.55	5.12
17				13.55	7.39	6.42	6.29	4.52	7.78	4.64	6.20	5.65
18				12.62	7.95	7.20	5.28	6.81	6.84	5.12	6.40	5.42
19		5.24	4.95	12.08	8.26	5.22	5.60	5.08	6.59	4.45	6.76	5.48
20	4.21			11.60	6.60	4.90	5.72	4.03	6.33	5.39	6.54	5.06
21				11.36	7.66	5.02	5.78	4.56	5.66	4.84	6.68	5.04
22		5.09		11.20	6.08	5.60	4.30	4.77	6.25	5.59	5.76	5.14
23				10.41	6.82	8.51	4.32	8.73	6.45	5.88	6.10	4.76
24	5.13			10.02	10.06	5.26	5.04	5.28	7.68	7.02	5.98	5.41
25	4.82		5.42	9.62	6.75	5.04	6.69	10.20	6.70	6.28	5.22	4.56
26		5.23	4.88	9.28	8.16	6.11	5.32	5.32	6.34	8.51	6.15	4.58
27			5.32	8.76	9.82	6.41	4.77	8.33	5.95	9.10	6.57	4.89
28			5.42	8.45	10.94	6.86	4.88	5.54	5.62	8.54	7.18	4.81
29	4.65		5.28	8.07	11.05	8.87	3.56	9.33	6.22	8.32	7.43	4.82
30			5.50	7.36	9.82	5.54	4.72	5.59	5.38	7.84	7.34	4.38
31			7.47		9.45		4.52	5.50		7.60		4.82

NOTE.—River frozen January 1 to March 30. From January 1 to about February 20 and March 25 to 30 there was an open channel west of the gage which varied in width during this period from 50 to 180 feet. The river was open about 150 feet below the gage January 1 to February 15 and about 50 feet above the gage throughout the ice period. Fluctuations of daily gage heights during the open period are due almost wholly to "flooding for logs" by lumbermen. The following comparative readings were taken:

Comparative water and ice gage readings of Chippewa River near Eau Claire, Wis.

Date.	Water surface.	Top of ice.	Thickness of ice.
January 20	4.2	4.8	1.0
January 24			1.1
January 29	4.65	4.95	1.1
February 1	4.9	5.0	1.1
February 5	4.95	5.15	1.2
February 9	5.05	5.25	1.4
February 12	5.2	5.4	1.6
February 15	5.0	5.05	1.7
February 19	5.25	5.35	1.9
February 22	5.1	5.2	1.5
February 26	5.25	5.45	1.3
March 1	5.75	5.8	.9
March 5	5.45	5.5	1.0
March 8	5.15	5.25	.8
March 12			1.5
March 15	4.95	5.05	.9
March 19	4.95	5.05	.9

Rating table for Chippewa River near Eau Claire, Wis., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.50	1,040	4.90	3,820	6.30	7,300	8.40	13,600
3.60	1,210	5.00	4,050	6.40	7,640	8.60	14,240
3.70	1,390	5.10	4,280	6.50	7,920	8.80	14,890
3.80	1,570	5.20	4,520	6.60	8,200	9.00	15,550
3.90	1,760	5.30	4,760	6.70	8,480	9.20	16,210
4.00	1,950	5.40	5,000	6.80	8,770	9.40	16,890
4.10	2,140	5.50	5,250	6.90	9,060	9.60	17,570
4.20	2,340	5.60	5,500	7.00	9,350	9.80	18,250
4.30	2,540	5.70	5,760	7.20	9,930	10.00	18,950
4.40	2,740	5.80	6,020	7.40	10,530	11.00	22,550
4.50	2,950	5.90	6,280	7.60	11,130	12.00	26,350
4.60	3,160	6.00	6,550	7.80	11,730	13.00	30,350
4.70	3,380	6.10	6,820	8.00	12,350	14.00	34,500
4.80	3,600	6.20	7,090	8.20	12,970	15.00	38,750

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1902-1906. It is well defined between gage heights 4 feet and 15 feet.

Monthly discharge of Chippewa River near Eau Claire, Wis., for 1906.

[Drainage area, 6,740 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft per sq. mile.	Depth in inches.
April	38,100	10,400	24,900	3.69	4.12
May	22,700	6,770	13,500	2.00	2.31
June	20,000	3,820	10,000	1.48	1.65
July	13,700	1,140	5,350	.794	.92
August	19,600	1,330	6,220	.923	1.06
September	17,400	2,910	6,970	1.03	1.15
October	15,900	1,120	6,270	.930	1.07
November	10,600	4,570	8,310	1.23	1.37
December	9,090	2,700	4,810	.714	.82

NOTE.—Values for 1906 are excellent. During January, February, and March the flow probably seldom exceeded 3,000 second-feet and may have attained a minimum of 1,500 second-feet, or less.

FLAMBEAU RIVER NEAR LADYSMITH, WIS.

This station was established February 13, 1903. It is located three-fourths mile south of the Minneapolis, St. Paul and Sault Ste. Marie Railway station, three-fourths mile south of Ladysmith, and one-half mile below the dam of the Menasha Pulp Company. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 62, where are given also references to publications that contain data for previous years.

No powers have been developed on Flambeau River for 70 miles above Ladysmith, but a fall of 353 feet in this distance insures many opportunities for development. At two localities—Little Falls and Big Falls—the power possibilities are of special importance. The first is in the NW. ¼ sec. 21, T. 35 N., R. 5 W., and is owned by A. J. McGilvary and B. D. Viles, of Chippewa Falls. A 15-foot dam at the head of the first rapids would give a head of about 25 feet at the foot of the rapids a short distance below. Big Falls, owned by

the John Heim Company, of Tony, Wis., is 6 miles above Little Falls, in sec. 35, T. 36 N., R. 5 W. There is a descent of 25 feet here in a short distance, concentrated in three pitches, a view of one of which is shown in Pl. III, B.

Discharge measurements of Flambeau River near Ladysmith, Wis., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 26	M. S. Brennan	344	501	16.13	[a] 632
April 16	Horton and Brennan	380	2,630	20.74	10,800

[a] Entirely frozen over. Gage height to bottom of ice, 15.33 feet; thickness of ice varied from 0.8 to 2 feet; water surface 0.3 to 0.5 foot below ice surface. The discharge was about 40 per cent of the open-channel rating at gage height 16.13 feet.

Daily gage height, in feet, of Flambeau River near Ladysmith, Wis., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	16.72	.....	.....	16.92	17.82	17.35	16.80	15.20	16.15	16.15	20.25	19.55
2	16.90	.....	.....	16.92	18.05	17.30	16.92	15.75	16.25	15.70	20.25	19.00
3	16.85	.....	.....	17.00	17.65	17.15	17.10	16.20	16.12	15.80	20.30	.....
4	17.35	16.80	17.10	17.85	18.30	16.90	16.80	15.25	16.10	15.40	20.50	.....
5	16.65	.....	.....	18.15	18.60	16.82	16.82	15.70	16.05	16.00	20.10	.....
6	17.10	.....	.....	18.20	18.55	17.15	16.20	17.15	16.10	15.20	20.55	.....
7	.....	.....	.....	18.05	18.20	17.78	16.35	17.30	16.35	15.80	20.05	.....
8	.....	.....	.....	17.45	17.78	18.25	16.10	16.95	15.50	14.90	19.55	.....
9	.....	.....	.....	18.15	17.52	17.90	16.35	16.30	15.55	15.75	19.40	.....
10	.....	.....	.....	18.38	17.40	18.20	16.38	16.20	15.70	15.85	19.90	.....
11	.....	17.10	15.60	18.30	17.18	17.72	16.40	16.35	15.60	15.72	19.85	.....
12	.....	.....	.....	19.05	17.10	17.45	16.52	16.20	15.65	15.70	17.05	.....
13	.....	.....	.....	19.65	17.10	17.40	16.60	16.15	16.65	15.70	16.45	.....
14	16.70	.....	.....	20.50	17.02	16.85	16.35	16.00	17.12	15.65	16.35	.....
15	.....	.....	.....	20.72	17.25	16.80	16.20	16.00	17.15	15.60	16.50	.....
16	.....	.....	.....	20.65	17.00	16.65	16.40	15.80	17.08	15.75	16.70	.....
17	.....	.....	17.10	20.48	17.50	16.55	16.30	15.90	17.10	15.65	16.75	.....
18	.....	.....	.....	20.35	16.68	16.30	16.20	15.70	17.12	17.05	16.70	.....
19	.....	17.00	.....	20.40	16.68	16.10	16.10	15.35	17.10	[a] 18.50	17.00	.....
20	.....	.....	.....	20.40	16.85	16.10	15.95	15.60	16.78	19.75	16.60	.....
21	16.30	.....	.....	20.40	16.65	16.32	16.60	16.45	16.28	19.65	16.30	.....
22	.....	.....	.....	20.10	16.90	16.60	15.88	16.75	17.02	19.70	16.55	.....
23	.....	.....	.....	19.75	16.95	16.50	15.75	16.80	17.08	19.5	18.05	.....
24	.....	.....	.....	19.45	17.32	16.75	15.68	17.00	16.15	19.75	19.30	.....
25	.....	17.4	16.60	19.00	17.32	16.58	16.00	16.65	16.65	20.20	19.35	.....
26	.....	.....	.....	18.70	17.50	16.60	15.55	17.05	16.58	24.40	19.30	.....
27	.....	.....	.....	18.45	17.80	16.62	15.70	16.55	16.25	20.50	19.45	.....
28	16.70	.....	.....	18.05	17.70	16.50	15.65	16.45	16.40	20.45	19.45	.....
29	.....	.....	.....	18.05	17.38	16.82	15.75	16.35	16.20	20.20	19.50	.....
30	.....	.....	.....	17.90	17.80	17.40	15.55	16.20	16.55	20.50	19.55	.....
31	.....	.....	.....	.....	17.50	.....	15.00	16.50	.....	20.40	.....	.....

[a] October 18 a dam below the station was closed, raising the water at the section.

NOTE.—River frozen January 6 to April 4, approximately; also December 3 to 31. During January the average ice thickness was about 1 foot, while during February and March it was 1.6 feet.

Rating table for Flambeau River near Ladysmith, Wis., from January 1, 1906, to October 17, 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
14.90	535	16.20	1,735	17.50	3,700	19.40	7,710
15.00	600	16.30	1,855	17.60	3,890	19.60	8,170
15.10	670	16.40	1,980	17.70	4,090	19.80	8,630
15.20	745	16.50	2,110	17.80	4,300	20.00	9,090
15.30	825	16.60	2,245	17.90	4,510	20.20	9,550
15.40	910	16.70	2,385	18.00	4,720	20.40	10,030
15.50	1,000	16.80	2,530	18.20	5,140	20.60	10,510
15.60	1,090	16.90	2,680	18.40	5,560	20.80	11,000
15.70	1,185	17.00	2,835	18.60	5,980	21.00	11,500
15.80	1,285	17.10	2,995	18.80	6,400	22.00	14,100
15.90	1,390	17.20	3,160	19.00	6,820	23.00	16,800
16.00	1,500	17.30	3,330	19.20	7,260	24.00	19,600
16.10	1,615	17.40	3,510				

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-1906. It is well defined between gage heights 15.5 feet and 21 feet. Owing to the closure of a dam below the section the table is not applicable after October 17, 1906.

Monthly discharge of Flambeau River near Ladysmith, Wis., for 1906.

[Drainage area, 2,120 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April (5-30)	10,800	3,600	7,310	3.45	3.34
May	5,980	2,320	3,680	1.74	2.01
June	5,240	1,620	2,900	1.37	1.53
July	3,000	600	1,770	.835	.96
August	3,330	745	1,860	.877	1.01
September	3,080	1,000	2,730	1.29	1.44
October (1-17)	1,340	910	1,170	.552	.35

NOTE.—Values for 1906 are probably excellent. During the frozen period the discharge probably seldom exceeded 1,500 second-feet and may have declined to a minimum of 500 or less. See ice measurement.

FLAMBEAU RIVER SURVEY.

In order to point out the power possibilities along the Flambeau River a survey was made during 1906 from Flambeau to a point near the western border of Lac Du Flambeau Indian Reservation; the section from the mouth to Flambeau had been surveyed by the Geological Survey in 1902. From the data collected sheets have been prepared showing a profile of the water surface, a plan of the river, contour along the bank, and prominent natural or artificial features. The results of this survey have been published on separate sheets and may be had on application to the Director of the Geological Survey.

BLACK RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Black River rises in the southeastern part of Taylor County, Wis., at an elevation between 1,300 and 1,400 feet above tide, flows in a general southwesterly direction for a distance of 128 miles, and joins

the Mississippi about 10 miles above the town of La Crosse. Its basin, wedged in between that of the Wisconsin on the east and the Chippewa on the west, is long and narrow, being at one point scarcely more than 3 miles wide. The total area drained is 2,272 square miles.

The surface of the basin is gently rolling or level, and the country about the lower part of the river is well settled and under cultivation. The southern portion of the pine region crosses the basin between 60 and 80 miles from the mouth of the river, and all of the upper half of the area is forested. There are a few lakes at the upper waters, but the basin is not well supplied with natural reservoirs.

The river has a total fall of about 750 feet between source and mouth, or over 4.5 feet a mile. At Black River Falls there are very heavy rapids for a short distance, over hard granite rock. The tributaries, which are characterized by many rapids and moderate falls, are all small streams of little importance, though they furnish power for a few small mills.

BLACK RIVER SURVEY.

In order to point out the power possibilities along Black River a survey was made during 1906 from Black River Falls to Wisconsin Central Railway crossing. From the data collected on this survey sheets have been prepared showing a profile of the water surface, a plan of the river, contour along the bank, and prominent natural or artificial features. The results of this survey have been published on separate sheets and may be had upon application to the Director of the Geological Survey.

BLACK RIVER AT NEILLSVILLE, WIS.

This station was established April 7, 1905. It is located at the lower highway bridge at Neillsville, Wis., about 40 rods below the Chicago, St. Paul, Minneapolis and Omaha Railway bridge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 65.

Discharge measurements of Black River at Neillsville, Wis., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 25	M. S. Brennan	147	198	4.30	[a] 152
April 24	do	165	484	4.75	819
June 3	do	160	436	4.46	752

[a] Entirely frozen over; gage height given to water surface; ice 1.3 feet thick. The discharge was 22 per cent of the open-channel rating for gage height 4.30 feet.

Daily gage height, in feet, of Black River at Neillsville, Wis., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.5	4.1	5.1	9.4	4.2	5.1	3.7	3.2	3.2	2.7	4.2	5.5
2	3.3	4.1	5.0	11.8	4.6	4.8	3.5	3.0	4.5	2.9	3.9	5.2
3	3.4	4.1	5.2	12.0	5.0	4.3	3.9	2.8	4.5	2.7	3.8	4.9
4	3.5	4.1	5.0	11.6	5.2	4.0	4.2	2.6	4.7	2.7	3.9	4.5
5	3.4	4.0	4.9	11.3	5.1	4.2	4.0	2.8	4.5	2.7	3.8	4.2
6	3.4	4.0	4.9	11.0	4.7	6.3	3.6	3.0	3.0	2.5	3.7	3.8
7	3.5	4.0	4.8	10.6	4.4	6.9	3.3	2.9	3.8	2.5	3.7	4.2
8	3.5	3.9	4.8	11.4	4.2	6.6	3.1	2.8	3.4	2.5	3.7	4.5
9	3.4	3.9	5.3	10.7	4.3	5.9	3.0	2.4	2.9	2.5	3.6	4.7
10	3.5	3.8	5.1	10.0	4.3	5.4	3.1	2.4	3.0	2.5	3.7	4.8
11	3.5	3.8	4.9	8.9	4.1	4.6	3.0	2.4	3.0	2.7	3.6	4.8
12	3.5	3.8	4.9	8.7	3.9	4.1	3.0	2.5	3.0	2.4	3.6	4.8
13	3.5	4.0	4.8	8.5	6.9	3.8	2.8	2.4	3.0	2.4	3.3	4.6
14	3.5	3.9	4.7	8.8	7.3	3.5	2.8	2.4	2.9	2.4	3.2	4.3
15	3.6	3.9	4.6	8.5	6.6	3.3	2.8	2.3	2.9	2.4	3.3	4.3
16	3.6	3.9	4.5	7.6	5.9	3.2	2.7	2.3	3.3	2.5	3.2	4.5
17	3.7	3.8	4.5	6.7	5.4	3.1	2.7	2.4	3.3	2.5	4.1	4.6
18	3.8	3.9	4.4	6.2	4.9	3.0	2.6	2.4	3.4	2.7	5.1	4.6
19	3.8	3.9	4.3	6.0	4.5	2.9	2.7	2.3	3.3	2.7	4.8	4.5
20	3.8	4.1	4.3	6.0	4.1	3.0	2.7	2.3	3.2	3.0	4.6	.....
21	4.0	4.2	4.4	5.8	4.0	3.1	2.6	2.2	3.2	3.5	4.4	.....
22	4.0	4.3	4.3	5.4	4.0	3.6	2.6	2.6	3.1	3.4	3.7	.....
23	4.0	4.4	4.2	4.9	4.1	3.9	2.2	3.0	3.0	3.4	3.8	.....
24	4.0	4.6	4.1	4.8	4.2	4.1	2.1	3.8	3.2	3.7	3.6	.....
25	4.0	4.8	4.2	4.4	6.0	3.9	2.1	4.1	3.2	4.2	3.8	.....
26	4.0	4.9	5.1	4.4	5.9	3.7	2.4	4.4	3.1	5.2	5.5	.....
27	4.1	5.1	6.0	4.3	9.3	3.9	2.4	4.3	3.0	5.2	6.7	.....
28	4.1	5.1	6.6	4.2	8.3	4.1	2.5	4.1	3.0	4.9	6.6	.....
29	4.1	.....	7.2	4.1	7.2	4.2	2.4	3.9	2.9	4.7	6.3	.....
30	4.1	.....	[a] 11.5	4.2	6.5	3.9	4.0	3.7	2.8	4.5	6.2	.....
31	4.1	.....	8.5	.....	5.8	.....	3.7	3.4	.....	4.2	.....	.....

[a] Ice jam.

NOTE.—Ice conditions January 1 to March 30 and December 20 to 31.

Rating table for Black River at Neillsville, Wis., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	20	3.60	338	5.10	1,185	7.20	2,850
2.20	26	3.70	379	5.20	1,250	7.40	3,050
2.30	34	3.80	424	5.30	1,315	7.60	3,250
2.40	44	3.90	473	5.40	1,385	7.80	3,460
2.50	56	4.00	525	5.50	1,455	8.00	3,680
2.60	70	4.10	579	5.60	1,525	8.20	3,900
2.70	86	4.20	635	5.70	1,600	8.40	4,120
2.80	105	4.30	692	5.80	1,675	8.60	4,340
2.90	126	4.40	750	5.90	1,750	8.80	4,580
3.00	150	4.50	810	6.00	1,825	9.00	4,820
3.10	177	4.60	870	6.20	1,985	10.00	6,020
3.20	205	4.70	930	6.40	2,145	11.00	7,300
3.30	235	4.80	990	6.60	2,310	12.00	8,700
3.40	267	4.90	1,055	6.80	2,480		
3.50	301	5.00	1,120	7.00	2,660		

NOTE. The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1905 and 1906. It is well defined between gage heights 3.3 feet and 7.7 feet. Beyond these limits the discharge is only approximate.

Monthly discharge of Black River at Neillsville, Wis., for 1906.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
April	8,700	579	3,860
May	5,180	473	1,450
June	2,570	126	730
July	635	20	184
August	750	26	188
September	930	105	274
October	1,250	44	298
November	2,400	205	733
December (1-19)	1,460	424	874

NOTE.—Values for 1906 are good, except July and August, which are fair. During the frozen period the discharge probably seldom exceeded 500 second-feet and attained a minimum of at least 150, and probably much less.

WISCONSIN RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Wisconsin River, the largest stream in the State of Wisconsin, rises in Lac Vieux Desert, a sheet of water about 10 square miles in area which lies directly on the line separating the upper peninsula of Michigan from Wisconsin, and enters the Mississippi just below Prairie du Chien. The river flows southward for 300 miles to the city of Portage; it then turns sharply and flows west and southwest for the remainder of the distance to its mouth. Its drainage basin, 12,280 square miles in extent, has an average width of about 50 miles and is 225 miles long. From source to mouth the distance by water is approximately 400 miles. The stream lies for the most part in the eastern half of the basin, and below the bend at Portage it flows within about 10 miles of its southern edge.

The country drained is rolling, and in places decided ridges break the surface. In the headwater region are many lakes and tamarack swamps, and all the way down to Portage there is more or less swamp land between the ridges. The wooded (pine) country extends from the Michigan boundary line down to within 40 miles, by river, of the city of Portage. Below that point the pine disappears, and a semi-prairie region gradually takes the place of the woods. In the southern part of the basin the Baraboo ranges of quartzite pass east and west from 400 to 700 feet above the surrounding country, and the bluffs along the lower river, especially on the south side, form prominent ramparts to the valley. Back from these the land is level or undulating.

Owing to the form of the basin and the position of the river in it there are no very large tributaries. The wooded character of all the upper portion of the drainage area aids in maintaining the flow of the stream during the dry and cold seasons and makes the Wisconsin one of the most uniform in flow of all the large tributaries of the Mississippi.

The elevation of the headwaters is 1,532 feet above the sea, and that of the mouth about 600 feet. Hence in a course estimated to be 407 miles the river falls 932 feet, or about 2.29 feet per mile. The most rapid part is in the upper portion of the stream, and here are the available water powers. At the rapids the river flows over a rocky bed, but at intermediate places the bed is largely made up of sand, gravel, and bowlders.

In the 53 miles between the foot of the upper dam at Merrill and the foot of the Rhinelander dam the river has a natural descent of 277 feet, an average of 5.2 feet per mile. In this stretch, besides several other fine powers, are included Grandfather Rapids, the largest water power on the river, developed or undeveloped. These rapids begin in the NE. ¼ sec. 30, T. 33 N., R. 6 E., and extend to the SW. ¼ sec. 31, a distance of 1½ miles, and are the most noted rapids on the river. A view of them is shown in Pl. IV, *A*. The descent in this distance is 89½ feet. The high bank and the bed of the river are in hard rock. For nearly thirty years the Wisconsin River Logging Association has maintained three logging dams on these rapids. It is probable that the cheapest method of developing this power would be to construct three dams of 30 feet head each, and that the power could be best employed by paper mills. The site is about midway in the 20-mile stretch from Merrill to Tomahawk.

About 1.5 miles above Grandfather Rapids are some small rapids where an 8.9-foot dam would back the water to the foot of Grandmother Rapids.

WISCONSIN RIVER SURVEY.

In order to point out the power possibilities along the Wisconsin River, a survey was made during 1906 between Sauk City and Dekorra and between Lewiston Station and Jersey City. From the data collected sheets have been prepared, showing a profile of the water surface, a plan of the river, contour along the bank, and prominent natural or artificial features. The results of this survey have been published on separate sheets and may be had upon application to the Director of the Geological Survey.

EAU CLAIRE RIVER SURVEY.

In order to point out the power possibilities along the Eau Claire River, a survey was made during 1906 from the mouth to Johnson. From the data collected sheets have been prepared, showing a profile of the water surface, a plan of the river, contour along the bank, and prominent natural or artificial features. The results of this survey have been published on separate sheets and may be had upon application to the Director of the Geological Survey.

WISCONSIN RIVER NEAR RHINELANDER, WIS.

This station was established December 1, 1905. It is located about 8 miles southwest of Rhinelander, Wis., at the highway bridge about 400 feet below Forbes and Wixson's dam and power station.

A. GRANDFATHER RAPIDS, WISCONSIN RIVER, WISCONSIN.

B. EVAPORATION STATION, MADISON, WIS.

The channel is straight for 400 feet above and below the bridge. The banks are of medium height, but do not overflow. The bed of the river is rocky and is permanent; the current is swift.

Discharge measurements are made from the lower side of the two-span highway bridge; the initial point for soundings is the right end of the downstream railing of the bridge.

A standard chain gage, which was read during 1906 by E. H. Miller and Charles Hagen, is attached to the upstream side of the bridge. Length of chain, 18.97 feet. The bench mark is the head of the right bolt on the upstream side of the top of the right upstream cylinder pier. It is marked with white paint and the letters "B. M."; elevation, 13.96 feet above the gage datum. The reference point is the center of pulley of gage; elevation, 17.12 feet above the gage datum.

Discharge measurements of Wisconsin River near Rhinelander in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 27	M. S. Brennan	209	473	2.71	[a] 1,040
April 17	Horton and Brennan	215	822	4.25	2,580
June 12	M. S. Brennan	216	656	3.60	2,050

[a] Narrow strip of ice along shore.

Daily gage height, in feet, of Wisconsin River near Rhinelander, Wis., for 1905–6.

Day.	1905.	1906.										
	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.5	3.0	2.6	2.8	2.8	3.4	3.1	4.1	2.8	3.1	2.4	2.95	3.1
2	2.4	3.0	2.6	2.5	3.0	3.3	3.2	3.1	2.7	2.4	2.5	3.1	2.65
3	2.25	2.75	3.0	2.95	3.0	3.3	2.8	4.0	3.1	3.0	2.5	3.0	3.0
4	2.4	2.9	2.7	2.95	2.95	3.9	3.1	3.6	3.15	2.9	2.5	2.1	3.1
5	3.0	2.75	2.8	2.4	3.0	3.9	3.2	2.1	1.4	3.3	2.8	2.9	2.8
6	3.1	2.75	2.9	2.9	2.8	4.2	3.6	3.1	3.1	2.6	2.8	3.1	2.3
7	3.05	2.6	3.1	2.8	3.0	3.4	4.3	3.3	2.9	2.5	1.8	2.9	3.0
8	3.1	3.0	2.9	2.4	3.3	3.5	3.9	2.5	3.0	2.8	2.9	2.9	2.65
9	3.2	2.8	2.9	2.7	3.1	3.6	4.3	2.7	3.0	1.7	3.0	2.8	2.9
10	3.0	2.7	2.55	2.8	3.2	3.4	4.4	2.8	2.8	2.1	3.0	2.5	2.7
11	3.0	2.9	2.6	2.6	3.9	3.5	3.5	3.0	2.5	2.5	2.8	2.1	2.9
12	3.2	2.8	2.1	2.6	4.3	3.6	3.6	3.15	2.7	2.7	2.9	2.4	2.7
13	3.1	2.7	2.8	3.0	4.0	3.3	3.5	2.5	2.9	2.6	2.9	2.9	2.85
14	3.2	2.5	2.7	2.95	4.2	3.2	3.4	2.8	2.9	2.4	2.2	2.4	2.8
15	3.0	2.7	2.6	3.0	4.3	2.6	3.2	2.6	2.9	2.8	2.5	2.6	2.8
16	3.05	2.7	2.65	2.7	3.8	3.1	3.2	2.85	2.8	2.0	2.8	2.45	2.6
17	2.85	2.9	2.7	2.75	4.4	3.2	2.8	2.8	2.8	2.4	3.15	2.5	2.7
18	2.9	2.7	2.7	2.5	4.1	3.3	2.4	2.8	2.7	2.5	3.0	1.8	2.3
19	3.1	2.8	2.4	2.7	4.5	3.3	3.0	2.85	1.8	2.5	3.0	2.4	2.9
20	3.1	2.75	2.4	2.8	4.6	3.1	3.1	2.8	2.7	2.5	3.1	2.8	2.5
21	2.7	2.8	2.45	2.8	4.4	3.2	3.2	2.3	2.7	2.7	2.9	2.3	2.7
22	2.95	2.75	2.5	2.7	4.7	3.1	3.5	2.0	2.9	2.6	2.6	2.2	2.7
23	3.3	2.75	2.4	2.5	4.0	3.1	3.3	2.2	3.0	1.8	3.0	2.1	2.5
24	2.9	2.9	3.2	2.7	3.9	3.0	2.5	2.9	3.6	2.3	2.9	2.2	2.5
25	3.0	2.8	2.7	2.9	3.6	2.95	3.1	3.0	3.1	2.4	3.0	1.4	2.9
26	2.7	2.8	2.9	3.0	3.5	3.2	3.2	3.1	2.5	2.45	3.1	2.4	2.6
27	2.9	2.75	2.9	2.95	3.5	1.8	3.7	2.9	2.8	2.4	3.1	2.8	2.3
28	2.7	2.6	3.0	2.8	3.4	3.1	3.1	3.0	3.2	2.4	3.1	3.0	2.8
29	2.6	2.9	.....	2.5	3.9	3.05	3.7	2.0	3.25	2.6	3.1	3.2	2.8
30	2.8	3.0	.....	2.3	3.6	3.6	3.7	2.9	3.0	2.6	3.1	3.1	2.2
31	2.6	2.7	.....	2.7	.....	3.7	.....	2.6	2.9	.....	3.0	.....	2.7

NOTE.—No ice record.

WISCONSIN RIVER AT MERRILL, WIS.

This station was established November 17, 1902. It is located on the highway bridge in the city of Merrill, three blocks from the Lincoln County court-house, one-half mile from the Chicago, Milwaukee and St. Paul Railway station, and 1,000 feet below the dam of the electric-power house. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 68, where are given also references to publications that contain data for previous years.

Discharge measurements of Wisconsin River at Merrill, Wis., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 24[a]	M. S. Brennan	331	1,090	5.92	1,980
April 23[b]	do	334	2,300	8.26	10,000

[a] Partly frozen; discharge about 50 per cent of open channel rating. [b] Logs running.

Daily gage height, in feet, of Wisconsin River, at Merrill, Wis., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.6	5.5	5.75	5.65	7.35	6.55	6.65	4.45	5.85	3.5	6.05	5.9
2	5.75	5.9	5.7	5.7	7.65	6.65	6.45	4.6	6.45	4.5	5.7	5.8
3	6.45	5.5	5.45	6.15	7.8	6.45	7.0	5.2	6.4	4.8	6.0	5.6
4	6.3	5.9	5.2	6.7	7.6	5.85	7.2	5.3	6.35	5.0	5.95	5.5
5	6.85	5.6	5.75	7.65	7.75	7.35	6.85	5.45	6.15	4.75	5.0	5.7
6	5.95	5.65	6.0	7.45	7.75	8.15	6.55	5.05	5.9	5.05	5.75	5.6
7	5.8	5.5	5.65	7.6	7.3	8.25	6.95	5.05	5.6	4.85	5.45	5.45
8	5.7	5.8	5.9	7.5	6.8	7.95	7.5	5.1	5.3	4.45	5.85	5.5
9	5.5	5.6	5.8	8.0	6.45	8.1	5.7	5.15	5.0	4.75	5.65	5.3
10	5.55	5.9	5.4	9.75	6.75	7.75	5.75	5.6	5.0	4.15	5.25	4.8
11	6.05	5.8	4.95	9.8	6.95	7.5	5.7	5.5	4.8	5.3	5.35	5.5
12	5.95	5.65	6.0	9.75	7.0	7.5	5.8	5.9	4.7	5.25	4.9	5.4
13	5.75	5.65	5.6	10.0	6.6	6.7	5.65	4.8	5.55	5.3	5.2	5.7
14	5.8	5.55	6.15	10.05	6.65	6.4	5.8	5.2	5.6	5.0	5.0	5.5
15	5.65	5.7	5.8	9.95	6.65	6.1	5.5	5.05	5.65	4.35	5.65	5.4
16	5.95	5.25	5.9	9.45	6.7	6.1	4.55	5.6	5.7	4.85	5.3	5.4
17	6.35	5.05	6.05	9.2	6.95	5.7	5.6	5.15	3.75	5.15	5.45	5.4
18	6.15	5.1	5.75	9.25	6.4	5.55	5.25	5.2	5.05	5.3	5.15	5.35
19	5.65	5.2	5.6	9.5	6.55	5.85	5.25	5.05	5.45	5.95	5.45	5.2
20	5.65	5.3	5.6	9.55	6.8	6.4	5.15	3.3	5.4	5.1	5.55	5.1
21	5.9	5.75	5.9	9.4	7.2	6.65	5.05	5.6	5.4	5.9	5.75	5.4
22	5.75	5.85	5.75	9.15	6.95	5.8	4.15	6.55	5.75	5.6	5.7	4.95
23	6.0	5.8	5.8	8.85	6.6	5.75	3.5	7.55	5.5	5.6	5.25	5.0
24	5.6	5.65	5.85	8.25	6.55	6.15	5.5	7.15	4.45	5.85	5.1	4.8
25	5.2	5.95	5.6	8.25	6.95	6.7	5.55	6.8	5.55	6.95	5.45	5.0
26	5.5	5.7	5.95	8.0	7.05	6.2	5.15	8.45	5.1	6.65	5.4	5.4
27	5.9	5.5	6.15	7.55	6.4	6.1	4.35	7.75	5.35	6.5	5.5	5.4
28	5.6	5.95	5.7	7.3	6.8	6.05	4.95	7.25	5.0	6.15	6.1	5.7
29	5.7	.....	5.35	6.95	6.55	5.9	5.15	7.1	5.15	6.0	6.3	5.5
30	5.55	.....	5.8	7.4	7.2	6.45	3.8	5.95	4.7	6.1	6.3	5.6
31	5.85	.....	5.65	.....	6.95	.....	5.0	5.45	.....	6.1	.....	4.8

NOTE.—No ice record by observer. Probably ice conditions during January to March and December.

Rating table for Wisconsin River at Merrill, Wis., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.50	790	4.80	1,950	6.10	4,210	7.80	8,480
3.60	840	4.90	2,090	6.20	4,420	8.00	9,070
3.70	895	5.00	2,230	6.30	4,640	8.20	9,680
3.80	955	5.10	2,380	6.40	4,860	8.40	10,310
3.90	1,020	5.20	2,540	6.50	5,090	8.60	10,960
4.00	1,090	5.30	2,700	6.60	5,320	8.80	11,620
4.10	1,170	5.40	2,870	6.70	5,560	9.00	12,300
4.20	1,260	5.50	3,040	6.80	5,800	9.20	12,980
4.30	1,360	5.60	3,220	6.90	6,050	9.40	13,680
4.40	1,460	5.70	3,410	7.00	6,300	9.60	14,380
4.50	1,570	5.80	3,600	7.20	6,820	9.80	15,080
4.60	1,690	5.90	3,800	7.40	7,360	10.00	15,800
4.70	1,820	6.00	4,000	7.60	7,910		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906. It is fairly well defined between gage heights 5 feet and 8.5 feet. Below gage height 4.5 feet it is only approximate.

Monthly discharge of Wisconsin River at Merrill, Wis., for 1905–6.

[Drainage area, 2,630 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
April	13,000	2,960	7,170	2.73	3.05
May	8,480	2,460	5,640	2.14	2.47
June	18,000	3,040	9,920	3.77	4.21
July	9,680	1,360	5,290	2.01	2.32
August	5,920	1,950	4,090	1.56	1.80
September	7,220	3,900	5,010	1.91	2.13
October	5,920	1,360	4,410	1.68	1.94
November	4,640	1,950	3,150	1.20	1.34
1906.					
April	16,000	3,320	10,400	3.95	4.41
May	8,480	4,860	6,230	2.37	2.73
June	9,840	3,130	5,510	2.09	2.33
July	7,630	790	3,450	1.31	1.51
August	10,500	700	3,770	1.43	1.65
September	4,980	925	2,950	1.12	1.25
October	6,180	790	2,900	1.10	1.27
November	4,640	2,090	3,170	1.21	1.35

NOTE.—Gage heights for 1905 are published in Water-Supply Paper No. 171. Discharge values for 1905 and 1906 are excellent, although logging may affect the results to a slight degree. Ice conditions assumed January, February, March, and December. Discharge as given by the measurements on January 24, 1906, is about 50 per cent of the open-channel rating.

WISCONSIN RIVER NEAR NECEDAH, WIS.

This station was established December 2, 1902. It is located on the highway toll bridge 3 miles east of Necedah, Wis., and 3 miles from the Chicago, Milwaukee and St. Paul and the Chicago and Northwestern railway stations. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 70, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Wisconsin River near Necedah, Wis., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		8.5	7.6	8.0	8.2	4.8	6.7	4.8	6.65	8.5
2		9.85	7.7	7.8	7.65	4.8	6.8	5.2	6.4	7.9
3		9.5	7.65	7.5	7.4	4.8	5.9	4.8	6.7	7.0
4		9.8	7.5	7.4	7.85	4.9	6.0	4.6	6.7	7.1
5	6.5	10.2	7.6	7.2	8.0	4.9	6.2	4.8	6.2	7.1
6	6.7	10.4	7.7	6.4	7.8	4.7	6.45	4.9	6.1	6.6
7	6.5	11.6	7.7	6.0	7.2	5.3	6.25	4.85	6.0	6.5
8	6.5	13.0	7.85	7.4	6.75	4.9	6.1	4.4	5.55	6.5
9	6.5	13.0	7.5	8.45	6.4	5.05	5.9	4.85	5.4	6.5
10	6.5	12.9	7.35	8.75	6.35	4.8	5.3	4.9	5.1	6.1
11	6.4	13.0	7.1	8.6	6.3	4.95	5.8	4.75	5.75	6.6
12	6.4	13.2	7.0	8.4	6.0	5.0	5.2	4.8	5.9	6.7
13	6.4	13.0	6.9	7.8	6.0	5.0	4.9	4.6	5.9	6.2
14	6.4	12.85	6.75	7.4	5.8	5.3	4.9	5.1	5.3	5.9
15	6.4	13.0	7.5	6.9	5.6	5.0	4.95	4.75	5.3	5.85
16	6.4	13.3	8.1	6.8	5.5	4.95	4.9	5.15	5.3	6.0
17	6.4	13.3	7.85	6.7	5.1	5.0	5.15	5.0	5.2	6.4
18	6.4	12.9	7.8	6.3	5.3	5.05	5.7	4.8	5.2	7.6
19	6.3	12.1	7.25	6.4	5.3	4.8	5.2	4.65	5.7	7.6
20	6.3	11.3	7.2	5.9	5.3	4.7	4.9	4.8	6.4	.....
21	6.4	11.0	6.85	6.3	5.35	5.1	5.0	5.1	6.35	.....
22	6.4	10.8	6.7	6.8	5.35	4.8	5.25	5.55	6.35	.....
23	5.7	10.6	6.6	8.1	5.2	4.9	5.3	6.0	5.7	.....
24	5.7	10.1	6.2	8.3	5.05	5.95	5.2	5.75	5.4	.....
25	6.2	9.6	6.4	7.7	5.1	6.7	5.6	5.75	5.6	.....
26	6.5	9.15	6.4	7.3	5.05	6.9	5.45	6.0	5.6	.....
27	6.7	8.75	6.4	7.7	5.0	6.7	5.3	7.0	6.5	.....
28	7.1	8.4	7.2	8.3	5.2	7.3	5.15	7.1	7.1	.....
29	7.1	8.2	8.75	8.4	4.5	7.9	5.2	6.9	8.0	.....
30	7.9	7.9	8.7	8.6	5.1	7.5	5.15	7.0	8.9	.....
31	7.9	.....	8.5	.....	4.6	7.15	.....	6.6	.....	.....

NOTE.—Ice conditions January 1 to April 2, approximately. During March ice 1.6 feet thick. Ice conditions from about December 17 to 31.

Rating table for Wisconsin River near Necedah, Wis., for 1904–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.50	2,810	5.60	5,380	6.60	8,200	8.20	13,000
4.60	3,020	5.70	5,640	6.70	8,500	8.40	13,600
4.70	3,240	5.80	5,900	6.80	8,800	8.60	14,200
4.80	3,460	5.90	6,170	6.90	9,100	8.80	14,800
4.90	3,690	6.00	6,440	7.00	9,400	9.00	15,400
5.00	3,920	6.10	6,720	7.20	10,000	9.20	16,000
5.10	4,150	6.20	7,010	7.40	10,600	9.40	16,600
5.20	4,390	6.30	7,300	7.60	11,200	9.60	17,200
5.30	4,630	6.40	7,600	7.80	11,800	9.80	17,800
5.40	4,880	6.50	7,900	8.00	12,400	10.00	18,400
5.50	5,130						

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904 and 1905. It is well defined between gage heights 4.5 feet and 10.5 feet. From gage height 6.3 feet to 11 feet the rating curve is a tangent, the difference being 300 per tenth. Above 11 feet the bank overflows, causing the discharge to increase at a greater rate per foot rise of gage.

Monthly discharge of Wisconsin River near Necedah, Wis., for 1906.

[Drainage area, 5,800 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April	35,400	12,100	22,600	3.90	4.35
May	14,600	7,010	10,500	1.81	2.09
June	14,600	6,170	10,800	1.86	2.08
July	13,000	2,810	6,570	1.13	1.30
August	12,100	3,240	5,240	.903	1.04
September	8,800	3,690	5,140	.886	.99
October	9,700	2,600	4,840	.834	.96
November	15,100	4,150	6,760	1.17	1.30
December (1-19)[a]	13,900	6,040	8,160	1.41	1.00

[a] Discharge values December 17 to 19 corrected for ice conditions.

NOTE.—Values for 1906 good.

WAPSIPINICON RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Wapsipinicon River rises in Mower County, Minn., and flows southeastward, entering the Mississippi near Shafton, Scott County, Iowa. Its total drainage area is 2,300 square miles.

The river is generally fairly constant in flow, though its headwaters are sometimes low. As a rule, its banks are moderately high and the stream is well confined. There are numerous small power sites on this stream at Toronto, Oxford Mills, Newport, Anamosa, Central City, Troy Mills, Quasqueton, Independence, and Littleton. At several of these points, notably at Anamosa, there are good opportunities for building dams.

WAPSIPINICON RIVER AT STONE CITY, IOWA.

This station was established August 19, 1903. It is located in Stone City at the highway bridge, just above the Chicago, Milwaukee and St. Paul Railway bridge, and near the Dearborn stone quarry. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 73, where are given also references to publications that contain data for previous years.

Discharge measurements of Wapsipinicon River at Stone City, Iowa, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 12	M. S. Brennan	125	173	2.68	[a] 95
March 7	A. H. Horton	186	1,490	10.26	4,750
March 31	M. S. Brennan	189	2,200	13.64	9,340
April 2	do	181	1,430	9.88	4,580

[a] Stream frozen entirely across; thickness of ice, 0.9 foot. The discharge was about 60 per cent of the open-channel rating for gage height, 2.68 feet.

Daily gage height, in feet, of Wapsipinicon River at Stone City, Iowa, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1			9.42	12.45	3.62	3.95	2.95	2.90	2.72	3.08	2.66
2			10.02	10.00	3.60	4.32	2.92	2.90	2.68	3.02	2.80
3	2.76		11.00	8.70	3.59	5.02	3.02	2.82	2.65	3.00	2.78
4			11.92	7.75	3.55	5.44	3.12	2.85	2.61	2.92	2.90
5			10.80	7.42	3.55	5.30	3.35	2.82	2.60	2.85	2.78
6			10.10	6.98	3.52	4.80	3.42	3.12	2.64	2.84	2.80
7		3.04	9.30	6.85	3.50	4.35	3.40	3.04	2.62	2.80	2.76
8			8.80	6.70	3.48	3.92	3.30	3.00	2.62	2.78	2.74
9	2.68		8.50	7.45	3.58	3.73	3.22	3.26	2.62	2.74	2.72
10			8.15	7.92	3.60	3.50	3.15	3.26	2.63	2.72	2.70
11			7.50	8.20	3.58	3.48	3.12	3.40	2.62	2.68	2.68
12	2.68		7.10	8.20	3.52	3.34	3.10	3.68	2.72	2.66	2.66
13			6.35	7.88	3.48	3.25	3.35	3.68	2.82	2.68	2.65
14		3.26	5.45	7.20	3.44	3.25	3.08	3.56	2.72	2.64	2.65
15			5.50	6.54	3.40	3.28	3.00	3.42	2.71	2.64	2.74
16			5.60	6.40	3.36	3.40	2.94	3.40	2.70	2.62	2.74
17	3.02		5.45	6.23	3.38	3.35	2.90	3.35	2.75	2.62	2.75
18			4.95	5.90	3.52	3.24	2.85	3.22	2.76	2.62	2.72
19		3.35	4.72	5.62	3.35		2.82	3.12	2.85	2.62	2.70
20		3.80	4.64	5.38	3.32	3.10	2.74	3.05	2.90	2.58	2.68
21		5.05	4.30	5.05	3.25	3.10	2.80	3.00	2.95	2.56	2.70
22		6.12	4.16	4.78	3.30	3.10	2.90	2.94	3.15	2.61	2.62
23	3.75	7.44	3.92	4.55	3.60	3.06	2.88	2.91	3.32	2.60	2.54
24		7.95	3.80	4.38	4.02	3.02	2.81	2.85	3.52	2.64	2.52
25		8.40	3.84	4.12	4.30	3.04	2.80	2.90	3.55	2.62	2.68
26		8.55	4.45	3.96	4.30	2.92	2.72	2.96	3.54	2.60	2.98
27		8.95	6.09	3.85	4.02	2.98	2.76	2.92	3.42	2.62	2.92
28		9.55	7.42	3.72	3.95	2.96	2.78	2.88	3.30	2.64	3.12
29			8.90	3.65	4.02	2.94	2.88	2.84	3.22	2.64	3.08
30			10.82	3.60	3.84	2.98	2.96	2.80	3.15	2.65	3.08
31	3.16		13.66		3.75		2.92	2.79		2.66	

NOTE.--River frozen January 1 to March 2; thickness of ice increasd from 0.5 foot January 3 to 13 feet February 14. River also frozen November 23 to 27 and December 7 to 31. During December the thickness of the ice was about 0.3 foot.

Rating table for Wapsipinicon River at Stone City, Iowa, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.50	115	3.70	570	4.90	1,185	7.20	2,580
2.60	137	3.80	620	5.00	1,240	7.40	2,710
2.70	162	3.90	670	5.20	1,350	7.60	2,840
2.80	189	4.00	720	5.40	1,460	7.80	2,980
2.90	218	4.10	770	5.60	1,580	8.00	3,120
3.00	250	4.20	820	5.80	1,700	9.00	3,850
3.10	286	4.30	870	6.00	1,820	10.00	4,640
3.20	326	4.40	920	6.20	1,940	11.00	5,520
3.30	370	4.50	970	6.40	2,060	12.00	6,560
3.40	420	4.60	1,020	6.60	2,190	13.00	7,770
3.50	470	4.70	1,075	6.80	2,320	14.00	9,160
3.60	520	4.80	1,130	7.00	2,450		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-1906. It is well defined above gage height 2.7 feet.

Monthly discharge of Wapsipinicon River at Stone City, Iowa, for 1906.

[Drainage area, 1,310 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
March	8,690	620	2,890	2.21	2.55
April	7,100	520	2,170	1.66	1.85
May	870	348	531	.405	.47
June	1,480	224	523	.399	.45
July	430	167	258	.197	.23
August	560	186	293	.224	.26
September	495	137	236	.180	.20
October	279	128	166	.127	.15
November	294	119	180	.137	.15

NOTE.—Values for 1906 are excellent. During the winter period the minimum flow was probably at least as low as 40 second-feet.

ROCK RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Rock River rises in the southeastern part of Wisconsin, flows south and southwest, and enters the Mississippi just below Rock Island, Ill. Its length is 286 miles. Of the total drainage area (11,000 square miles), 5,650 square miles are in Wisconsin and 5,350 in Illinois. The length of the basin is 175 miles; its greatest width is near the Wisconsin-Illinois State line, where for 20 miles or more it averages about 80 miles; above the boundary it averages 40 or 50 miles in width, while below, in Illinois, it narrows rapidly.

In the upper part of its course the river flows rather toward the eastern side of the basin, but near the State line it approaches the center, and finally flows decidedly near the western boundary of its drainage area. The total fall of the stream, distributed with comparative uniformity throughout its length, is 340 feet, an average of 1.2 feet per mile.

The country drained is undulating and comprises large expanses of unbroken prairie, groves, and extensive bodies of timber, swamp, and lake.

The data collected in this basin are valuable for water-power purposes.

ROCK RIVER AT ROCKTON, ILL.

This station was established May 13, 1903. It is located at the Rockton highway bridge, one-half mile from the Chicago, Milwaukee and St. Paul Railway station, 1 mile below the dam, and three-fourths mile below the junction of Pecatonica River with Rock River. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 76, where are given also references to publications that contain data for previous years.

Discharge measurements of Rock River at Rockton, Ill., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 31	M. S. Brennan	503	2,390	5.79	8,240
February 24	do	510	4,300	9.85	16,000
February 25	do	510	4,740	10.55	18,600
February 27	do	510	4,130	9.36	15,400
February 27	do	510	4,180	9.45	16,500
February 28	do	510	4,000	9.13	14,900
May 3	do	494	1,430	4.10	4,570

NOTE.—Measurements January 31 to February 28, inclusive, were slightly affected by ice conditions below the gaging section.

Daily gage height, in feet, of Rock River at Rockton, Ill., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Oct.	Nov.	Dec.
1	3.3	5.45	8.8	8.7	4.15	3.15	3.3	1.1	1.5	3.25
2	2.95	5.0	8.8	8.45	4.15	3.0	3.2	1.4	1.6	3.0
3	2.85	5.72	11.15	7.95	4.1	2.8	3.15	1.3	1.4	2.85
4	3.9	5.45	10.8	7.0	4.1	2.45	3.05	1.2	1.5	2.7
5	4.57	6.75	10.0	6.25	4.0	2.8	3.0	1.1	1.45	2.6
6	4.9	6.9	10.25	6.15	3.9	2.8	2.9	1.05	1.55	2.9
7	4.9	5.75	9.85	6.1	3.95	2.8	2.85	1.4	1.55	2.65
8	5.6	7.15	9.45	6.15	3.85	2.8	2.7	1.15	1.5	2.25
9	6.25	6.5	9.25	6.65	3.8	2.6	2.7	1.1	1.4	2.4
10	6.0	5.45	8.75	7.0	3.7	2.6	2.6	1.0	1.4	2.4
11	4.85	5.75	8.4	7.0	3.6	2.55	2.6	1.1	1.4	2.35
12	4.0	5.7	8.8	6.45	3.6	2.7	2.5	1.1	1.35	2.35
13	3.5	4.7	6.05	6.8	3.4	2.6	2.4	1.1	1.45	2.3
14	3.1	4.7	6.2	6.4	3.5	2.5	2.45	1.1	1.4	2.3
15	3.4	5.88	6.2	6.15	3.5	2.5	2.5	1.0	1.4	2.3
16	8.4	5.7	6.0	6.25	3.45	2.5	2.45	.95	1.3	2.0
17	7.25	5.45	6.25	6.05	3.2	2.3	2.5	1.0	1.15	2.0
18	7.1	5.1	5.61	5.9	3.15	2.3	2.4	1.0	1.3	2.0
19	7.3	4.3	5.31	5.75	3.0	2.45	2.3	.95	1.1	2.15
20	7.3	5.0	5.0	5.6	2.95	2.35	2.4	1.0	1.3	2.2
21	9.62	9.4	4.75	5.4	3.05	2.7	.....	1.25	1.3	2.0
22	9.5	9.1	4.3	5.35	2.9	2.6	.....	1.25	1.75	2.0
23	7.85	8.83	4.5	5.25	2.9	2.7	.....	1.3	1.95	2.0
24	8.7	9.25	4.4	5.0	2.9	2.65	.....	1.25	1.75	2.0
25	9.3	10.7	4.4	4.8	2.85	2.6	.....	1.3	1.8	1.5
26	9.5	9.85	4.65	4.7	2.9	2.75	.....	1.35	2.4	2.5
27	9.15	9.4	8.21	4.55	3.1	2.6	.....	1.4	3.4	1.5
28	8.3	9.25	8.3	4.53	3.4	2.5	.....	1.5	3.9	1.5
29	7.8	.....	8.7	4.5	3.2	3.1	.....	1.6	3.85	1.65
30	7.1	.....	8.8	4.21	3.6	3.3	.....	1.6	3.65	1.45
31	6.05	.....	8.75	.....	3.5	.....	.....	1.7	.....	3.6

NOTE.—Ice conditions January 5 to 10 and February 8 to 20; slight ice conditions during December. Gage heights are to water surface. This station was temporarily discontinued from July 21 to September 30.

Rating table for Rock River at Rockton, Ill., for 1904–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	500	2.10	1,470	3.20	3,105	4.60	5,760
1.10	560	2.20	1,600	3.30	3,280	4.80	6,180
1.20	624	2.30	1,740	3.40	3,455	5.00	6,620
1.30	692	2.40	1,880	3.50	3,635	5.20	7,070
1.40	764	2.50	2,025	3.60	3,815	5.40	7,540
1.50	840	2.60	2,170	3.70	3,995	5.60	8,020
1.60	925	2.70	2,320	3.80	4,180	5.80	8,520
1.70	1,020	2.80	2,470	3.90	4,365	6.00	9,020
1.80	1,122	2.90	2,620	4.00	4,555	7.00	11,520
1.90	1,234	3.00	2,775	4.20	4,940	9.00	16,520
2.00	1,350	3.10	2,935	4.40	5,345	11.00	21,520

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906. It is well defined between gage heights 2.4 feet and 6 feet. The table has been extended beyond these limits, being based on one measurement at 13.32 feet. Above gage height 5.6 feet the rating curve is a tangent, the difference being 250 per tenth. Below gage height 2 feet the rating is approximate.

Monthly discharge of Rock River at Rockton, Ill., for 1906.

[Drainage area, 6,150 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	18,100	2,540	9,620	1.56	1.80
February	19,000	4,000	9,760	1.59	1.66
March	20,300	5,140	11,800	1.92	2.21
April	15,800	4,960	9,160	1.49	1.66
May	4,840	2,540	3,590	.584	.67
June	3,280	1,740	2,280	.371	.41
July 1-26	3,280	1,740	2,330	.379	.28
October	1,020	472	641	.104	.12
November	4,360	560	1,280	.208	.23
December	3,190	802	1,740	.283	.33

NOTE.—Values are rated as follows: January and March, good; February and October, approximate; April to July, excellent; November and December, fair. Discharge for ice periods corrected.

ROCK RIVER NEAR NELSON, ILL.

This station was established June 8 and was discontinued July 21, 1906. It is located about 1¼ miles west of Nelson, Ill., at the Chicago and Northwestern Railway bridge.

The channel is straight for 1,000 feet above and below the station. The right bank is high and does not overflow; the left bank is low and overflows. All of the discharge passes the section. The bed of the river is rocky and permanent, and the current is of moderate swiftness. The remains of old piers and an island above the station may affect the flow.

Discharge measurements were made from the downstream side of the five-span railway bridge to which the gage is attached. The initial point for soundings is the center of the right floor beam, which rests upon the right abutment.

The standard chain gage, which was read once each day by John McGlaughlin, is located on the lower side of the bridge about the center of the second span from the left side. Length of chain, 31.28 feet.

The bench mark is the top of the downstream end of the floor beam 363 feet from the right end of bridge; elevation, 30 feet above the gage datum.

Discharge measurements of Rock River near Nelson, Ill., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 4	M. S. Brennan	621	3,020	6.19	5,380
June 5	A. H. Horton	602	2,260	5.02	2,720
June 30	do	615	2,920	6.12	5,190

Daily gage height, in feet, of Rock River near Nelson, Ill., for 1906.

Day.	June.	July.	Day.	June.	July.
1		6.2	16	4.7	4.7
2		5.6	17	4.65	4.6
3		5.6	18	4.55	4.7
4		5.5	19	4.35	4.5
5		5.6	20	4.85	4.5
6		5.3	21	5.0	4.6
7		5.2	22	5.0	
8	5.2	5.1	23	4.8	
9	5.05	5.0	24	4.85	
10	5.0	4.8	25	4.7	
11	4.75	4.9	26	4.8	
12	4.65	4.9	27	4.85	
13	4.85	4.7	28	8.0	
14	4.9	4.7	29	6.4	
15	4.8	4.7	30	6.15	

ROCK RIVER AT STERLING, ILL.

This station was established January 5, 1905, and was discontinued March 3, 1906, on account of an ice gorge destroying the bridge. It was located on the new highway bridge in Sterling, Ill., about one-half mile below the dam of the Sterling Manufacturing Company. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 78, where are given also references to publications that contain data for previous years.

Discharge measurements of Rock River at Sterling, Ill., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 16[a]	M. S. Brennan	553	1,780	7.40	[c] 3,370
January 16[b]	do	282	1,220	8.20	[c] 2,300

[a] North channel. [b] South channel. [c] Ice conditions.

Daily gage height, in feet, of Rock River, at Sterling, Ill., for 1906.

Day.	North channel.		South channel.		Day.	North channel.		South channel.	
	Jan.	Feb.	Jan.	Feb.		Jan.	Feb.	Jan.	Feb.
1	6.04	14.71	5.88	15.72	17	7.00	13.10	7.04	14.90
2	6.06	14.64	5.90	15.64	18	6.98		7.02	
3	6.12	14.65	5.95	15.64	19	6.98		7.06	
4	6.12		5.98		20	7.00		7.10	
5	6.12		6.00		21	9.20		9.32	
6	6.16		6.06		22	[a] 11.84		[a] 11.94	
7	6.38		6.22		23	13.26		13.52	
8	6.46		6.29		24	14.38		14.78	
9	6.52		6.36		25	15.2		16.30	
10	6.58	13.00	6.40	14.10	26	15.45		16.50	
11	6.63		6.46		27	15.52		16.50	
12	6.77		6.66		28	15.3		16.52	
13	6.82		6.70		29	15.19		16.26	
14	6.88		6.77		30	14.78		15.66	
15	6.98		7.04		31	14.98		15.69	
16	6.98		7.04						

[a] Ice conditions January and February; both channels gorged with ice January 22 to February 25; South Channel bridge carried away February 22; North Channel bridge carried away February 25.

IOWA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Iowa River rises in north-central Iowa, flows in a southeasterly direction, and joins the Mississippi about 30 miles above Burlington. Its chief tributary is Cedar River, which rises in Minnesota and flows into the Iowa about 50 miles above the mouth of the latter. The total drainage area of the Iowa is 12,400 square miles, 4,470 square miles of this being tributary to it above its junction with Cedar River at Columbus Junction. Cedar River drains 7,600 square miles above its union with Iowa River.

The chief power plants in the Iowa basin are at Iowa City, Marshalltown, Cedar Rapids, Waterloo, and Cedar Falls. The data collected in this basin are valuable for water-power purposes.

IOWA RIVER AT IOWA CITY, IOWA.

This station was established June 1, 1903, and was discontinued July 21, 1906. It is located on the county bridge directly west of the university grounds. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 83, where are given also references to publications that contain data for previous years.

A measurement was made at this station on June 1, 1906, by M. S. Brennan, giving the following results:

Width, 171 feet; area, 735 square feet; gage height, —0.35 foot; discharge, 470 feet.

At the time of this measurement there was ice along the shore. Therefore the discharge was about 70 per cent of the open-channel rating.

Daily gage height, in feet, of Iowa River at Iowa City, Iowa, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1			9.3	6.8	1.9		
2			9.9	7.2	1.9		1.1
3		2.2	8.3	7.6	2.0		.9
4			7.7	7.6	1.9	1.3	2.3
5			6.8	7.6	1.8	1.2	1.8
6			6.6	7.6	1.7	1.5	1.5
7			5.8	7.0	1.7	1.5	1.2
8			4.7	6.1	1.9	1.3	.8
9		1.2	4.4	6.2	1.9	1.2	.4
10			4.0	5.8	1.8	.9	.4
11			3.4	5.5	1.6	.8	— .2
12			2.8	5.4		.6	— .3
13	—0.1		2.4	5.0	1.3	.6	— .5
14			2.0	4.7	1.1	.6	— .5
15			1.8	4.6	1.1	.5	— .7
16			1.8	4.2	1.0	.5	— .7
17		1.2	2.5	4.1	.9	.5	— .7
18			2.4	4.2	.9	.3	—1.0
19			1.8	4.3	.8	.5	— .8
20			2.7	4.2	.6	.6	— .9

Daily gage height, in feet, of Iowa River at Iowa City, Iowa, for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
21	6.0	.....	2.3	4.0	0.6	.....	−0.8
22	.....	.....	2.1	3.7	1.3	1.1	.....
23	.....	.....	1.9	3.4	1.8	1.0	.....
24	.....	7.6	1.4	3.1	2.1	1.1	.....
25	.....	8.0	1.4	2.8	2.3	1.1	.....
26	.....	8.0	5.95	2.5	.....	1.0	.....
27	2.7	9.4	5.4	2.2	2.5	.9	.....
28	.....	9.6	4.5	2.1	1.7	.7	.....
29	.....	.....	5.3	1.9	1.8	.6	.....
30	.....	.....	6.2	1.8	1.7	1.0	.....
31	.....	.....	6.6	.....	1.7	.....	.....

NOTE.—River frozen, January 1 to February 23; January 13, ice 0.8 foot thick; January 21, rise caused by ice jam; January 27, open water within 2 feet of gage; February 3, open water within 4 feet of gage; February 9, small opening below gage; February 17, gage reading to top of ice; February 24 and 25, ice jam. After June 3 gage heights were affected slightly by the construction of a dam below the station.

Rating table for Iowa River at Iowa City, Iowa, for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
−1.00	360	0.30	916	1.60	1,760	3.80	3,650
−0.90	392	0.40	971	1.70	1,830	4.00	3,840
−0.80	426	0.50	1,028	1.80	1,900	4.20	4,030
−0.70	462	0.60	1,087	1.90	1,970	4.40	4,220
−0.60	499	0.70	1,148	2.00	2,040	4.60	4,410
−0.50	538	0.80	1,210	2.20	2,190	4.80	4,600
−0.40	579	0.90	1,274	2.40	2,350	5.00	4,800
−0.30	622	1.00	1,340	2.60	2,520	6.00	5,900
−0.20	666	1.10	1,410	2.80	2,700	7.00	7,150
−0.10	712	1.20	1,480	3.00	2,890	8.00	8,540
0.00	760	1.30	1,550	3.20	3,080	9.00	10,040
0.10	810	1.40	1,620	3.40	3,270	10.00	11,600
0.20	862	1.50	1,690	3.60	3,460		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1905. It is well defined above gage height −1 foot.

Monthly discharge of Iowa River at Iowa City, Iowa, for 1906.

[Drainage area, 3,320 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft per sq. mile.	Depth in inches.
March	11,400	1,620	4,420	1.33	1.53
April	7,960	1,900	4,750	1.43	1.60
May	2,440	1,090	1,760	.530	.6[illegible]
June	1,760	916	1,310	.395	.44
July (1–21)	2,270	360	948	.286	.[illegible]

NOTE.—Values are rated as follows: March, June, and July, good; April and May, excellent. The minimum flow during ice period was at least as low as 470 second-feet.

CEDAR RIVER AT CEDAR RAPIDS, IOWA.

This station was established October 26, 1902. It is located at Cedar Rapids, Iowa, about 50 miles above the mouth of the river, and is near the city gas works and the plant of the Iowa Windmill and Pump Company. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 86, where are given also references to publications that contain data for previous years.

Discharge measurements of Cedar River at Cedar Rapids, Iowa, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 31	M. S. Brennan	658	6,550	11.82	32,900
March 31	do	658	6,060	11.05	29,900
April 1	do	653	4,390	8.60	20,200
April 1	do	658	4,740	9.15	22,200
April 2	do	651	3,740	7.60	15,700

Daily gage height, in feet, of Cedar River at Cedar Rapids, Iowa, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.0	3.35	8.25	8.2	4.15	5.55	3.75	3.5	3.35	4.05	3.75	4.15
2	2.9	3.55	7.4	7.1	4.15	5.3	3.7	3.45	3.3	4.0	3.65	4.15
3	2.85	3.6	7.55	6.3	4.15	4.95	3.8	3.4	3.3	3.9	3.65	4.05
4	2.85	3.55	7.5	6.05	4.3	4.7	3.7	3.35	3.25	3.85	3.6	4.1
5	2.9	3.5	7.4	5.8	4.5	4.5	3.8	3.3	3.55	3.75	3.6	4.05
6	2.9	3.45	7.2	5.6	4.45	4.35	4.05	3.3	3.65	3.75	3.6	4.0
7	3.0	3.55	6.65	5.55	4.4	4.25	3.85	3.7	3.7	3.6	3.55	3.95
8	3.2	3.65	6.3	5.55	4.35	4.2	3.75	3.85	3.65	3.55	3.55	3.15
9	3.15	3.5	5.8	5.75	4.2	4.2	3.6	4.4	3.6	3.45	3.5	3.45
10	2.8	3.45	5.6	5.8	4.1	4.2	3.55	4.3	3.55	3.45	3.45	3.35
11	2.8	3.45	5.4	5.7	4.05	4.15	3.45	4.6	3.45	3.45	3.5	3.4
12	2.75	3.4	5.2	5.65	4.0	4.05	3.45	4.95	3.4	3.4	3.6	3.45
13	2.85	3.35	4.3	5.8	3.95	3.95	3.45	4.9	3.35	3.4	3.55	3.6
14	3.0	3.35	4.15	5.65	3.95	3.9	3.45	4.65	3.3	3.3	3.55	3.85
15	3.15	3.3	4.25	5.45	3.9	3.85	3.4	4.4	3.3	3.25	3.55	4.45
16	3.15	3.3	4.4	5.55	3.85	3.75	3.35	4.25	3.2	3.3	3.55	4.7
17	3.25	3.3	4.35	5.75	4.0	3.7	3.4	4.05	3.3	3.3	3.55	4.2
18	3.2	3.45	4.3	5.9	5.05	3.65	3.4	4.0	3.35	3.3	3.55	4.35
19	3.15	3.5	4.25	5.85	5.85	3.75	3.35	3.85	3.5	3.25	3.55	4.05
20	3.0	4.3	4.25	5.55	6.35	3.65	3.35	3.85	4.4	3.3	3.55	3.9
21	3.9	4.5	4.2	5.3	5.9	3.55	3.4	3.8	4.6	3.25	3.6	3.95
22	4.5	4.6	4.2	5.2	5.45	3.6	3.45	3.65	4.55	3.25	3.65	4.65
23	3.8	5.55	4.15	4.8	5.1	3.65	3.55	3.65	4.5	3.2	3.5	4.5
24	3.5	5.45	4.2	4.65	4.75	3.8	.....	3.7	4.6	3.35	3.45	4.45
25	3.4	5.55	4.15	4.5	4.7	3.85	.....	3.65	4.75	3.35	3.5	4.45
26	3.4	5.85	5.1	4.4	4.5	3.75	.....	3.7	4.8	3.3	3.65	4.2
27	3.3	7.8	5.5	4.25	4.5	3.7	3.3	3.65	4.65	3.45	3.85	4.05
28	3.3	8.37	6.45	4.2	4.85	3.65	3.3	3.45	4.45	3.6	3.9	3.95
29	3.3	.....	10.29	4.15	4.95	3.6	3.25	3.4	4.25	3.8	3.9	3.8
30	3.25	.....	16.27	4.1	5.2	3.65	3.25	3.4	4.15	3.8	4.1	3.95
31	3.3	.....	12.1	.....	5.55	.....	3.3	3.35	.....	3.75	.....	4.25

NOTE.—River generally frozen over January 1 to March 15; open channel at gage during ice period; river frozen along shore December 17 to 31.

Rating table for Cedar River at Cedar Rapids, Iowa, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.70	600	3.80	2,575	4.90	6,150	6.00	10,000
2.80	720	3.90	2,875	5.00	6,500	6.20	10,750
2.90	840	4.00	3,175	5.10	6,850	6.40	11,510
3.00	970	4.10	3,475	5.20	7,200	6.60	12,280
3.10	1,110	4.20	3,800	5.30	7,550	6.80	13,060
3.20	1,270	4.30	4,125	5.40	7,900	7.00	13,850
3.30	1,440	4.40	4,450	5.50	8,250	8.00	17,800
3.40	1,625	4.50	4,775	5.60	8,600	10.00	25,700
3.50	1,825	4.60	5,100	5.70	8,950	12.00	33,600
3.60	2,050	4.70	5,450	5.80	9,300	14.00	41,500
3.70	2,300	4.80	5,800	5.90	9,650	16.00	49,400

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1906. It is well defined between gage heights 2.9 feet and 12 feet. Above gage height 7 feet the rating curve is a tangent, the difference being 395 per tenth.

Monthly discharge of Cedar River at Cedar Rapids, Iowa, for 1906.

[Drainage area, 6,320 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	4,780	660	1,350	0.214	0.25
February	19,300	1,440	4,200	.665	.78
March	50,500	3,640	11,000	1.74	2.01
April	18,600	3,480	8,210	1.30	1.45
May	11,300	2,720	5,240	.829	.96
June	8,420	1,940	3,400	.538	.60
July	3,320	1,360	1,880	.297	.34
August	6,320	1,440	2,860	.453	.52
September	5,800	1,270	5,810	.919	1.03
October	3,320	1,270	1,910	.302	.35
November	3,480	1,720	2,120	.335	.37
December	5,450	1,190	3,310	.524	.60
The year	50,500	660	4,270	.676	9.17

NOTE.—Discharge applied as for open channel during winter period, which may give somewhat excessive results. Values are rated as follows: January, February, and December, good; March to November, excellent.

RED CEDAR RIVER AT JANESVILLE, IOWA.

This station was established April 26, 1905, and was discontinued September 30, 1906. It is located on the Illinois Central Railroad bridge at Janesville, Iowa, about one-fourth mile below the highway bridge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 86, where are given also references to publications that contain data for previous years.

Discharge measurements of Red Cedar River at Janesville, Iowa, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 11	M. S. Brennan	136	178	1.70	[illegible]
March 18	A. H. Horton	236	1,118	5.72	[illegible]
March 28	M. S. Brennan	229	2,570	12.12	[illegible]
March 29	do	229	2,150	10.26	[illegible]
March 29	do	229	1,980	9.51	[illegible]
March 29	do	229	1,860	9.01	[illegible]
March 30	do	229	1,430	7.14	[illegible]
March 30	do	229	1,510	7.46	[illegible]

[a] River frozen entirely across. Gage height to bottom of ice, 0.70 foot; ice, 1.2 feet thick. Discharge about 70 per cent less than the open-channel rating at gage height 1.70 feet.
[b] Ice gorge one-fourth mile below station reduced the discharge about 50 per cent.

Daily gage height, in feet, of Red Cedar River at Janesville, Iowa, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.
1			6.7	4.9	1.8	3.8	1.7	1.3	[illegible]
2				4.1	2.0	3.2	1.6	1.2	[illegible]
3		1.9	10.0	3.8	2.2	2.8	1.5	1.1	[illegible]
4			9.4	3.6	2.5	2.6	1.8	1.1	[illegible]
5	1.7		8.8	3.5	2.4	2.4	1.5	1.1	[illegible]
6			7.6	3.5	2.2	2.3	1.4	1.4	[illegible]
7			6.2	3.6	2.0	2.3	1.4	1.3	[illegible]
8			5.7	3.5	1.9	2.7	1.3	1.9	[illegible]
9			6.0	3.8	1.8	2.6	1.2	2.3	[illegible]
10		1.7	4.0	4.1	1.7	2.6	1.2	3.6	[illegible]

Daily gage height, in feet, of Red Cedar River at Janesville, Iowa, for 1906—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
11	1.7	.....	.....	4.1	1.7	2.2	1.2	3.4	1.1
12	1.7	.....	6.1	4.0	1.7	2.0	1.1	2.7	1.2
13	.....	.....	6.1	3.7	1.6	1.9	1.2	2.2	1.1
14	.....	.....	6.2	3.8	1.6	1.8	1.2	2.0	1.0
15	.....	.....	5.7	5.1	1.6	1.7	1.2	1.7	1.0
16	.....	.....	5.5	5.6	4.5	1.6	1.2	1.6	1.0
17	.....	2.0	5.0	4.9	8.3	1.6	1.2	1.5	1.8
18	.....	.....	4.9	4.0	7.2	1.5	1.1	1.4	3.8
19	1.9	.....	4.6	3.4	5.6	1.5	1.1	1.4	4.3
20	.....	.....	4.0	3.0	4.0	1.5	1.1	1.3	3.5
21	.....	.....	4.1	2.8	3.3	1.5	[a] 1.1	1.2	3.1
22	.....	.....	3.6	2.6	2.7	1.4	1.1	1.2	2.9
23	.....	.....	3.6	2.5	2.4	1.4	1.1	1.2	4.5
24	.....	6.6	3.6	2.3	2.2	1.4	1.1	1.2	5.0
25	.....	8.3	2.4	2.2	2.3	1.3	1.1	1.2	4.5
26	.....	10.0	6.9	2.1	3.2	1.3	1.1	1.1	3.3
27	1.9	8.4	12.5	1.9	4.7	1.3	1.1	1.1	2.6
28	.....	8.1	13.3	2.0	6.1	1.3	1.1	1.1	2.2
29	.....	.....	10.1	1.9	6.3	2.0	1.5	1.1	2.0
30	.....	.....	7.2	1.8	6.0	1.5	1.7	1.0	1.8
31	.....	.....	6.0	.....	4.7	.....	1.4	1.0	.....

[a] Interpolated July 21 to 27.

NOTE.—Ice conditions January 1 to March 25: Thickness of ice January 12 to February 17, 1.3 feet. February 24 to March 1, ice broken up. March 3 to 9, river clear of floating ice but gorged below gage. March 12 to 21, river blocked with ice.

Rating table for Red Cedar River at Janesville, Iowa, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	380	2.40	1,300	3.80	2,340	6.40	4,560
1.10	440	2.50	1,370	3.90	2,420	6.60	4,760
1.20	500	2.60	1,440	4.00	2,500	6.80	4,970
1.30	560	2.70	1,510	4.20	2,660	7.00	5,190
1.40	620	2.80	1,580	4.40	2,820	7.20	5,420
1.50	680	2.90	1,650	4.60	2,980	7.40	5,660
1.60	740	3.00	1,720	4.80	3,140	7.60	5,910
1.70	810	3.10	1,790	5.00	3,300	7.80	6,180
1.80	880	3.20	1,860	5.20	3,470	8.00	6,500
1.90	950	3.30	1,940	5.40	3,640	9.00	8,270
2.00	1,020	3.40	2,020	5.60	3,820	10.00	10,500
2.10	1,090	3.50	2,100	5.80	4,000	11.00	13,500
2.20	1,160	3.60	2,180	6.00	4,180	12.00	17,000
2.30	1,230	3.70	2,260	6.20	4,370	13.00	21,100

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905–6. It is well defined between gage heights 1 foot and 12 feet.

Monthly discharge of Red Cedar River at Janesville, Iowa, for 1906.

[Drainage area, 1,840 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
March (26–31)	22,600	4,180	11,200	6.09	1.36
April	3,820	880	2,060	1.12	1.25
May	7,030	740	2,070	1.12	1.29
June	2,340	560	1,010	.549	.61
July	880	440	548	.298	.34
August	2,180	380	732	.398	.46
September	3,300	380	1,200	.652	.73

NOTE.—Values for 1906 are excellent. The flow during the winter period probably did not fall much below 240 second-feet.

DES MOINES RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Des Moines River rises in the southern part of Minnesota, flows to the south and southeast, and enters the Mississippi near Keokuk, Iowa. Its principal tributary is Raccoon River, which joins it at the city of Des Moines. The total drainage area of the Des Moines is 14,700 square miles. Above the mouth of the Raccoon its drainage area is 6,460 miles, while that of the Raccoon at its confluence with the Des Moines is 3,680 square miles.

The Des Moines is the largest stream in the State of Iowa and affords numerous opportunities for the development of water power. It is the natural recipient of the sewage of many towns.

DES MOINES RIVER AT FORT DODGE, IOWA.

This station was established April 22, 1905, and was discontinued July 19, 1906. It is located at the "Swede Town" bridge, the only highway bridge in Fort Dodge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 90.

Discharge measurements of Des Moines River at Fort Dodge, Iowa, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 3	M. S. Brennan	272	1,240	5.25	3,550
May 23	do	249	694	3.31	1,130

Daily gage height, in feet, of Des Moines River at Fort Dodge, Iowa, for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Day.	Mar.	Apr.	May.	June.	July.
1		5.7	5.9	3.8	3.5	17		6.25	4.0	3.15	2.8
2		5.45	6.1	3.6	3.35	18		6.15	3.9	3.1	2.6
3		5.25	6.05	3.85	3.3	19		6.0	3.7	3.6	2.7
4		5.2	5.8	3.8	3.25	20		5.95	3.5	4.0	
5		5.15	5.5	3.8	3.2	21		5.5	3.45	4.0	
6		5.2	5.15	3.8	3.2	22		5.5	3.45	4.0	
7		5.3	4.85	3.7	3.1	23		5.4	3.35	3.85	
8		5.45	4.65	3.7	3.05	24		5.1	4.1	3.75	
9		5.7	4.45	3.6	2.95	25		4.9	3.8	3.7	
10		5.85	4.25	3.5	2.9	26	9.9	4.7	3.8	3.7	
11		5.85	4.15	3.45	2.9	27	7.75	4.5	3.75	3.8	
12		5.75	4.0	3.35	2.7	28	7.75	4.5	3.7	3.85	
13		6.05	3.9	3.3	2.7	29	6.8	4.35	3.7	3.7	
14		6.25	3.8	3.3	2.8	30	6.25	4.25	3.7	3.6	
15		6.4	4.35	3.25	2.85	31	5.8				
16		6.4	4.1	3.2	2.85						

NOTE.—Ice conditions January 1 to March 25.

Rating table for Des Moines River at Fort Dodge, Iowa, for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.60	550	3.70	1,450	4.80	2,835	5.90	4,535
2.70	615	3.80	1,555	4.90	2,985	6.00	4,690
2.80	685	3.90	1,665	5.00	3,140	6.20	5,010
2.90	755	4.00	1,780	5.10	3,295	6.40	5,350
3.00	830	4.10	1,895	5.20	3,450	6.60	5,710
3.10	905	4.20	2,015	5.30	3,605	6.80	6,080
3.20	985	4.30	2,140	5.40	3,760	7.00	6,460
3.30	1,070	4.40	2,270	5.50	3,915	7.20	6,840
3.40	1,160	4.50	2,405	5.60	4,070	7.40	7,220
3.50	1,255	4.60	2,545	5.70	4,225	7.60	7,600
3.60	1,350	4.70	2,690	5.80	4,380	7.80	7,980

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1905 and 1906. It is well defined between gage heights 3.3 feet and 6 feet.

Monthly discharge of Des Moines River at Fort Dodge, Iowa, for 1906.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
March (26-31)	[a] 12,000	4,380	7,220
April	5,350	2,080	3,880
May	4,850	1,120	2,220
June	1,780	905	1,390
July (1-19)	1,260	550	828

[a] Discharge estimated.

NOTE.—Values are rated as follows: March to June, excellent; July, good.

DES MOINES RIVER AT DES MOINES, IOWA.

This station was established May 24, 1905, and was discontinued July 20, 1906. It was located at the Interurban Bridge at Des Moines, Iowa, near the suburb of Highland Park. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 92, where are given also references to publications that contain data for previous years.

Discharge measurements of Des Moines River at Des Moines, Iowa, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 10	A. H. Horton	284	1,910	7.50	3,420
April 4	M. S. Brennan	289	2,440	8.90	5,650
May 22	do	278	1,680	6.96	2,500

Daily gage height, in feet, of Des Moines River at Des Moines, Iowa, for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Day.	Mar.	Apr.	May.	June.	July.
1	8.6	10.2	7.8	6.6	6.2	17	8.0	11.7	8.2	6.1	5.7
2	8.4	9.1	8.5	6.6	6.1	18	7.9	11.5	8.0	6.1	5.8
3	8.3	8.8	9.3	6.6	6.1	19	8.0	10.4	7.8	6.9	5.8
4	8.3	8.75	9.6	6.5	6.1	20	8.0	9.3	7.7	6.6	5.8
5	7.9	9.0	9.4	6.5	6.05	21	7.6	9.35	7.5	6.4	.....
6	7.6	8.8	9.0	6.4	6.0	22	7.4	9.0	7.4	6.3	.....
7	7.6	8.75	8.4	6.4	6.0	23	7.4	8.6	7.3	6.3	.....
8	7.4	8.8	8.1	6.3	5.9	24	7.6	8.3	7.1	6.4	.....
9	7.3	8.9	7.7	6.3	5.9	25	7.7	7.6	7.1	6.3	.....
10	6.7	9.5	7.4	6.4	5.9	26	8.8	7.3	7.0	6.3	.....
11	6.9	9.7	7.2	6.4	5.7	27	9.6	7.5	6.9	6.2	.....
12	7.3	9.7	7.1	6.3	5.75	28	11.5	7.3	6.8	6.2	.....
13	8.0	10.3	7.0	6.2	5.8	29	12.5	7.3	6.7	6.1	.....
14	8.2	10.6	6.8	6.2	5.7	30	12.9	7.4	6.7	6.1	.....
15	8.1	11.1	6.8	6.2	5.8	31	11.8	.....	6.6	.....	.....
16	8.0	11.4	6.9	6.1	5.7						

NOTE.—River open March 1 to 12, but frozen March 13 to 25.

Rating table for Des Moines River at Des Moines, Iowa, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.20	790	6.60	2,130	8.00	4,100	9.80	7,320
5.30	860	6.70	2,250	8.10	4,260	10.00	7,700
5.40	940	6.80	2,370	8.20	4,430	10.20	8,100
5.50	1,020	6.90	2,490	8.30	4,600	10.40	8,500
5.60	1,100	7.00	2,620	8.40	4,770	10.60	8,900
5.70	1,190	7.10	2,760	8.50	4,940	10.80	9,300
5.80	1,280	7.20	2,900	8.60	5,110	11.00	9,700
5.90	1,370	7.30	3,040	8.70	5,290	11.20	10,100
6.00	1,470	7.40	3,190	8.80	5,470	11.40	10,520
6.10	1,570	7.50	3,340	8.90	5,650	11.60	10,940
6.20	1,680	7.60	3,490	9.00	5,830	11.80	11,360
6.30	1,790	7.70	3,640	9.20	6,200	12.00	11,780
6.40	1,900	7.80	3,790	9.40	6,570	13.00	13,940
6.50	2,010	7.90	3,940	9.60	6,940		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1905–6. It is well defined between gage heights 5.5 feet and 9 feet.

Monthly discharge of Des Moines River at Des Moines, Iowa, for 1906.

[Drainage area, 6,460 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
March	13,700	2,250	5,000	0.774	0.89
April	11,200	3,040	6,310	.977	1.09
May	6,940	2,130	3,580	.554	.64
June	2,490	1,570	1,840	.285	.32
July (1–20)	6,800	1,190	1,620	.251	.19

NOTE.—Values are rated as follows: March, good; April to July, excellent. Flow during March was probably not greatly affected by ice conditions.

DES MOINES RIVER AT KEOSAUQUA, IOWA.

This station was established May 30, 1903, and discontinued July 21, 1906. It is located on the county bridge, one-fourth mile above the old dam site and Government locks. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 94, where are given also references to publications that contain data for previous years. The data collected at this point are valuable for water-power purposes.

Discharge measurements of Des Moines River at Keosauqua, Iowa, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 13	M. S. Brennan	565	1,980	2.45	[a] 2,260
March 12	A. H. Horton	587	2,870	3.64	7,860
April 5	M. S. Brennan	588	4,290	5.93	14,600
May 21	do	584	2,710	3.34	6,960

[a] River frozen entirely across; gage height to bottom of ice is 2.10 feet; ice 0.3 to 1.0 foot thick. The discharge was about 50 per cent of the open-channel rating for gage height 2.45 feet.

Daily gage height, in feet, of Des Moines River at Keosauqua, Iowa, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	1.52	3.15	6.50	9.40	3.58	2.20	2.62
2	1.50	3.18	6.60	9.08	3.50	2.15	2.40
3	1.80	3.20	5.90	7.65	3.32	2.10	2.18
4	3.00	2.95	5.35	6.42	3.32	2.05	2.68
5	3.35	2.55	4.98	5.95	3.95	2.00	2.95
6	3.60	2.45	4.58	5.85	4.60	2.00	2.02
7	.....	2.20	4.12	5.62	4.70	2.42	1.70
8	.....	2.02	3.92	5.50	4.62	2.70	1.52
9	.....	1.85	4.40	5.75	4.42	2.60	1.42
10	.....	1.80	4.40	5.85	4.10	2.05	1.30
11	.....	3.15	4.00	6.52	3.75	1.88	1.28
12	.....	4.55	3.60	6.55	3.50	1.72	1.20
13	2.55	2.00	3.20	6.05	3.12	1.68	1.20
14	.....	3.45	3.05	6.22	2.95	1.60	1.25
15	.....	2.95	2.32	7.10	2.78	1.55	1.20
16	.....	3.40	2.02	7.82	2.68	1.48	1.10
17	.....	5.30	2.02	7.18	2.52	1.42	1.15
18	.....	5.60	2.08	7.75	2.80	1.40	1.18
19	.....	1.75	2.05	6.62	3.42	1.40	1.15
20	6.15	2.48	1.98	6.35	3.50	2.65	1.15
21	7.90	6.00	1.98	5.80	3.35	2.40	1.12
22	5.90	5.62	2.00	5.22	3.02	2.18	.....
23	3.95	7.30	2.20	4.88	2.75	2.00	.....
24	3.20	8.75	2.48	4.48	2.60	2.02	.....
25	3.10	10.65	2.55	4.22	2.45	1.92	.....
26	2.90	7.75	5.55	3.95	2.32	1.90	.....
27	2.48	6.02	8.70	3.68	2.25	1.88	.....
28	2.18	6.28	9.28	3.52	2.28	1.82	.....
29	2.08	.....	9.40	3.55	2.30	1.72	.....
30	2.30	.....	9.88	3.52	2.30	2.18	.....
31	2.72	.....	9.80	.....	2.25	.....	.....

NOTE.—Ice conditions January 4 to 20, February 11 to 18. Ice gorged February 15 to 18.

Rating table for Des Moines River at Keosauqua, Iowa, for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	1,350	2.40	4,285	3.70	7,740	6.00	14,550
1.20	1,550	2.50	4,540	3.80	8,010	6.20	15,210
1.30	1,755	2.60	4,795	3.90	8,280	6.40	15,870
1.40	1,965	2.70	5,055	4.00	8,550	6.60	16,530
1.50	2,180	2.80	5,320	4.20	9,090	6.80	17,210
1.60	2,395	2.90	5,585	4.40	9,650	7.00	17,890
1.70	2,615	3.00	5,850	4.60	10,220	8.00	21,290
1.80	2,840	3.10	6,120	4.80	10,800	9.00	24,790
1.90	3,070	3.20	6,390	5.00	11,400	10.00	28,390
2.00	3,305	3.30	6,660	5.20	12,000	11.00	32,090
2.10	3,545	3.40	6,930	5.40	12,620		
2.20	3,790	3.50	7,200	5.60	13,250		
2.30	4,035	3.60	7,470	5.80	13,890		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-1906. It is fairly well defined between gage heights 1.1 feet and 6.4 feet. The table has been extended beyond these limits, being based on one measurement at 15.7 feet.

Monthly discharge of Des Moines River at Keosauqua, Iowa, for 1906.

[Drainage area, 14,300 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	21,000	2,180	[a] 4,160	0.291	0.34
February	30,800	2,700	[b] 8,130	.569	.57
March	28,000	3,260	10,700	.748	.86
April	26,200	7,250	14,600	1.02	1.14
May	10,500	3,910	6,400	.448	.52
June	5,060	1,960	3,260	.228	.25
July (1-21)	5,720	1,350	2,480	.173	.11

[a] Discharge estimated January 4 to 20. [b] Discharge estimated February 11 to 18.

NOTE.—Values are rated as follows: January and February, fair; March to May, excellent; June and July, good.

ILLINOIS RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Illinois River, the most extensive of all the tributaries of the upper Mississippi, enters the main stream from the east about 24 miles above the mouth of the Missouri. Its drainage area of 29,000 square miles is distributed among three States—Illinois, Wisconsin, and Indiana: 24,700 square miles are in Illinois, extending in a broad band 250 miles long and averaging 100 miles in width directly across the center of the State in a northeast-southwest direction; 1,080 square miles are in Wisconsin, extending north from the Illinois area; and 3,210 square miles are in Indiana, projecting east from the same area.

The eastern projection is the basin of Kankakee River, while the northern one consists of the basins of Fox and Des Plaines rivers. The union of the drainages of these projections may be considered the origin of the Illinois. The name Illinois is applied to the river from the junction of the Kankakee and Des Plaines.

The region drained by the Illinois is level and undulating and includes some of the finest land in the United States. Many large and pro-

perous cities are situated within it, and it is covered with a network of railroads.

The drainage into the Illinois is quite evenly distributed along its course. The more important tributaries are Fox and Spoon rivers from the west, and the Kankakee, Vermilion, and Sangamon from the east.

ILLINOIS RIVER NEAR PEORIA, ILL.

This station was established March 10, 1903, and was discontinued July 21, 1906. It is located on the Peoria and Pekin Union Railroad bridge over the Illinois River, 1½ miles southwest of Peoria. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 97, where are given also references to publications that contain data for previous years. The data collected at this station are valuable for the purpose of studying the effect of the Chicago drainage canal on the river.

Discharge measurements of Illinois River near Peoria, Ill., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 15	M. S. Brennan	910	8,030	9.35	[a] 9,250
March 10	do	953	13,900	15.60	27,100
April 6	do	949	13,300	14.94	24,200
May 22	A. H. Horton	914	8,530	9.85	10,300

[a] No ice conditions.

Daily gage height, in feet, of Illinois River near Peoria, Ill., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	8.75	14.00	15.17	15.33	12.62	9.33	7.83
2	8.75	14.08	15.25	15.33	12.46	9.29	7.75
3	8.75	14.00	15.25	15.29	12.29	9.21	7.75
4	8.83	13.83	15.38	15.17	12.25	8.88	7.67
5	8.96	13.67	15.50	15.08	12.17	8.83	7.54
6	9.12	13.42	15.58	14.96	12.04	8.79	7.38
7	9.42	13.33	15.67	14.75	11.79	8.67	7.25
8	9.33	13.25	15.67	14.75	11.75	8.79	7.33
9	9.38	13.17	15.67	14.79	11.50	8.79	7.12
10	9.50	13.04	15.67	14.83	11.38	8.88	7.00
11	9.50	12.83	15.67	14.96	11.12	8.92	6.96
12	9.50	12.75	15.58	15.08	10.96	8.83	6.92
13	9.50	12.67	15.50	15.08	10.92	8.83	6.92
14	9.50	12.67	15.42	15.17	10.83	8.83	6.83
15	9.58	12.67	15.17	15.25	10.67	8.75	6.83
16	9.79	12.67	14.83	15.29	10.46	8.75	6.83
17	9.83	12.67	14.62	15.12	10.71	8.75	6.75
18	9.83	12.58	14.46	14.96	10.50	8.67	6.67
19	9.75	12.50	14.29	14.83	10.42	8.58	6.67
20	9.67	12.50	14.08	14.71	10.21	8.58	6.67
21	10.04	12.96	13.88	14.58	10.00	8.50	6.75
22	10.42	13.17	13.75	14.46	9.88	8.50	.....
23	10.50	13.50	13.67	14.17	9.75	8.50	.....
24	11.17	13.92	13.54	13.83	9.71	8.50	.....
25	11.79	14.25	13.46	13.67	9.54	8.38	.....
26	12.38	14.71	13.42	13.62	9.58	8.33	.....
27	12.83	15.12	13.79	13.38	9.62	8.21	.....
28	13.21	15.17	14.25	13.17	9.67	7.96	.....
29	13.38	.....	14.71	13.00	9.54	7.83	.....
30	13.62	.....	15.17	12.88	9.38	7.92	.....
31	13.79	.....	15.33	.....	9.29	.....	.....

NOTE.—Running ice during greater portion of January, February, and March.

Rating table for Illinois River near Peoria, Ill., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
6.60	6,100	8.10	7,660	9.60	9,710	12.20	15,210
6.70	6,200	8.20	7,780	9.70	9,870	12.40	15,730
6.80	6,300	8.30	7,900	9.80	10,040	12.60	16,270
6.90	6,400	8.40	8,020	9.90	10,210	12.80	16,820
7.00	6,500	8.50	8,140	10.00	10,390	13.00	17,400
7.10	6,600	8.60	8,260	10.20	10,760	13.20	17,990
7.20	6,700	8.70	8,390	10.40	11,140	13.40	18,590
7.30	6,800	8.80	8,520	10.60	11,540	13.60	19,210
7.40	6,900	8.90	8,650	10.80	11,960	13.80	19,840
7.50	7,000	9.00	8,790	11.00	12,390	14.00	20,480
7.60	7,110	9.10	8,930	11.20	12,830	15.00	24,090
7.70	7,220	9.20	9,080	11.40	13,280	16.00	28,600
7.80	7,330	9.30	9,230	11.60	13,740		
7.90	7,440	9.40	9,390	11.80	14,220		
8.00	7,550	9.50	9,550	12.00	14,700		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1906. It is well defined between gage heights 8.3 feet and 16 feet. Below gage height 8 feet the table is approximate.

Monthly discharge of Illinois River near Peoria, Ill., for 1906.

[Drainage area, 13,200 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	19,800	8,460	11,500	0.871	1.00
February	24,800	16,000	18,700	1.42	1.48
March	27,000	18,700	23,600	1.79	2.06
April	25,500	17,100	22,700	1.72	1.92
May	16,300	9,220	12,000	.909	1.05
June	9,280	7,360	8,350	.633	.71
July (1-21)	7,360	6,170	6,620	.502	.39

NOTE.—Values for 1906 are excellent, except those for July, which are good. Discharge during January to March probably only slightly reduced by floating ice.

DESPLAINES RIVER NEAR CHANNAHON, ILL.

This station was established October 23, 1902, and discontinued July 24, 1906. It is located just above the mouth of Jackson Creek, 2½ miles southwest and 2 miles east of Channahon, Ill. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 100, where are given also references to publications that contain data for previous years. The data collected at this station are valuable for the purpose of studying the effect of the Chicago drainage canal on the river.

Daily gage height, in feet, of Desplaines River near Channahon, Ill., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	83.42	82.18	81.95	.....	83.15	83.25	84.20
2	83.40	82.65	81.95	.....	82.95	83.22	84.25
3	83.42	82.58	81.28	82.90	82.90	83.15	84.18
4	83.30	82.68	81.44	82.90	82.82	83.16	84.22
5	83.50	82.44	81.36	82.90	82.90	83.15	84.12
6	83.30	82.52	81.75	82.92	82.95	83.15	84.18
7	83.05	82.55	82.05	82.95	82.98	83.12	84.28
8	83.00	82.61	82.25	82.60	83.00	83.22	84.08
9	83.18	82.68	82.32	82.22	83.15	83.26	84.10
10	82.82	82.82	82.42	81.82	83.16	83.28	84.05
11	82.80	83.00	82.45	81.84	83.08	83.25	83.95
12	82.78	82.82	82.50	81.90	83.24	83.20	83.92
13	82.68	82.86	82.75	82.15	83.25	83.26	83.82
14	82.88	82.45	83.00	82.25	83.10	83.24	84.02
15	82.95	83.02	82.50	82.36	83.15	83.22	83.82
16	83.05	82.59	83.00	82.42	82.90	83.28	83.98
17	82.85	82.56	82.98	82.58	83.05	83.28	84.00
18	82.85	82.68	82.98	82.52	83.12	83.24	83.92
19	82.72	82.74	82.88	82.62	83.18	83.21	83.90
20	82.70	82.78	83.40	82.78	83.15	83.18	83.85
21	82.36	80.98	83.35	82.80	83.11	83.25	83.65
22	80.60	81.70	83.50	82.93	83.18	83.30	83.20
23	80.98	81.45	82.90	83.00	83.24	83.22	83.42
24	81.72	80.25	83.20	83.08	82.98	83.22	83.85
25	81.92	79.82	83.05	83.05	83.10	83.66	.....
26	81.84	80.48	82.80	83.00	83.15	84.20	.....
27	81.98	81.20	81.90	82.98	.....	84.25	.....
28	82.00	81.60	81.90	83.09	83.10	84.25	.....
29	82.00	.....	81.80	83.10	83.30	.....	.....
30	81.82	.....	81.85	83.16	83.22	84.20	.....
31	81.21	.....	82.30	.....	83.15	.....	.....

NOTE.—No estimates have been published for 1905 or 1906, as no discharge measurements were made. So far as known, the 1904 rating table is applicable for these two years, but as the information is very meager, there is a large element of uncertainty.

KANKAKEE RIVER AT DAVIS, IND.

This station was established July 13, 1905, and was discontinued July 21, 1906. It is located at the railroad bridge at Davis, 8 miles west of Hamlet, Ind. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 101. The data collected are valuable in connection with the drainage of Kankakee Swamp.

Discharge measurements of Kankakee River at Davis, Ind., in 1905 and 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
August 22	M. S. Brennan	72	241	4.55	213
October 3	do	74	238	4.70	317
1906.					
April 28	E. F. Kriegsman	75	354	5.55	463
June 12	do	69	257	5.07	294
June 30	do	64	214	4.60	272

Daily gage height, in feet, of Kankakee River at Davis, Ind., for 1906.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1		5.4	4.9	4.8	17		5.1	4.9	4.6
2		5.5	4.8	4.6	18		5.0	4.8	4.5
3		5.5	4.8	4.5	19		5.0	4.7	4.4
4		5.5	4.8	4.6	20		4.9	4.9	4.2
5		5.4	4.8	4.6	21		4.9	5.0	4.1
6		5.3	4.8	4.5	22		4.8	4.9	.....
7		5.4	4.8	4.4	23		4.8	4.8	.....
8		5.4	5.0	4.4	24		4.8	4.8	.....
9		5.5	5.8	4.4	25		4.8	4.7	.....
10		5.4	5.8	4.4	26		4.8	4.7	.....
11		5.3	5.6	4.3	27		5.1	4.7	.....
12		5.2	5.5	4.2	28	5.5	5.2	4.7	.....
13		5.4	5.4	4.2	29	5.5	5.1	4.6	.....
14		5.5	5.3	4.3	30	5.5	5.0	4.6	.....
15		5.4	5.1	4.3	31		5.0	.....	.....
16		5.3	5.0	4.4					

Daily discharge, in second-feet, of Kankakee River at Davis, Ind.

JULY TO DECEMBER, 1905.[a]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		280	260	295	340	595	17	725	240	520	295	385	.....
2		280	690	295	360	570	18	500	225	520	340	385	.....
3		280	960	295	360	515	19	395	225	470	360	385	.....
4		280	1,110	295	340	.....	20	350	260	440	385	385	.....
5		225	1,140	295	360	.....	21	305	240	415	385	385	.....
6		420	1,110	295	360	.....	22	280	280	390	385	385	.....
7		350	960	295	510	.....	23	260	225	365	385	360	.....
8		280	750	295	510	.....	24	240	225	340	360	360	.....
9		225	605	295	485	.....	25	240	280	340	360	385	.....
10		225	575	315	460	.....	26	240	305	320	340	385	.....
11		225	520	315	435	.....	27	240	305	300	340	385	.....
12		225	495	315	410	.....	28	260	280	315	340	410	.....
13		260	470	295	410	.....	29	470	280	315	340	435	.....
14	1,000	225	445	275	385	.....	30	420	260	295	315	625	.....
15	1,030	225	395	275	385	.....	31	350	240	.....	295	.....	.....
16	940	260	420	275	385	.....							

APRIL TO JULY, 1906.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1		425	270	315	17		330	280	270
2		450	250	270	18		305	260	250
3		450	.....	250	19		305	240	235
4		450	.....	270	20		285	295	200
5		425	.....	270	21		285	315	190
6		385	.....	250	22		260	295	.....
7		410	250	235	23		.....	275	.....
8		410	280	235	24		.....	295	.....
9		435	470	235	25		.....	275	.....
10		410	470	235	26		260	275	.....
11		385	420	215	27		330	275	.....
12		360	390	200	28	450	335	290	.....
13		410	370	200	29	450	315	270	.....
14		435	345	215	30	450	295	270	.....
15		410	300	215	31		295	.....	.....
16		385	300	235					

[a] Gage heights for 1905 were published in Water-Supply Paper No. 171.

NOTE.—On account of the shifting character of the river the discharge has been obtained indirectly from the discharge measurements. (See introduction to Water-Supply Paper No. 211.)

Monthly discharge of Kankakee River at Davis, Ind., for 1905–6.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1905.			
July (14–31)	1,030	240	458
August	420	225	262
September	1,140	260	542
October	385	275	321
November	625	340	405
1906.			
May	450	260	355
June	470	240	301
July (1–21)	315	180	237

NOTE.—Values for 1905 and 1906 are approximate, owing to changing conditions of flow at the gaging section.

KANKAKEE RIVER AT MOMENCE, ILL.

This station was established February 22, 1905, and was discontinued July 20, 1906. It is located on the highway bridge in Momence, Ill., about one-half mile below the Chicago and Eastern Illinois Railway bridge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 102. The data collected at this station are valuable in connection with the drainage of Kankakee Swamp.

Discharge measurements of Kankakee River at Momence, Ill., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 9	M. S. Brennan	501	1,190	3.27	3,920
April 24	E. F. Kriegsman	473	851	2.75	2,350
April 27	do	466	822	2.68	2,230
June 13	do	440	592	2.12	1,200

Daily gage height, in feet, of Kankakee River at Momence, Ill., for 1906.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Day.	Feb.	Mar.	Apr.	May.	June.	July.
1	.....	2.70	2.95	2.52	2.00	1.80	17	.....	3.05	2.95	2.10	2.00	1.65
2	.....	2.70	2.90	2.50	2.00	1.80	18	.....	3.02	2.90	2.10	2.00	1.65
3	.....	3.30	2.90	2.45	2.00	1.80	19	.....	2.95	2.90	2.10	2.05	1.65
4	.....	3.42	2.90	2.42	2.00	1.80	20	.....	2.92	2.82	2.05	2.10	1.65
5	.....	3.35	2.90	2.38	2.00	1.80	21	2.68	2.85	2.80	2.02	2.08	.....
6	.....	3.25	3.00	2.35	1.95	1.78	22	2.70	2.82	2.80	2.00	2.08	.....
7	.....	3.20	3.02	2.30	1.98	1.73	23	2.75	2.78	2.75	2.00	2.05	.....
8	.....	3.35	3.05	2.25	2.08	1.70	24	2.85	2.75	2.75	1.98	2.00	.....
9	.....	3.30	3.42	2.25	2.20	1.70	25	3.10	2.78	2.70	1.95	1.95	.....
10	.....	3.30	3.50	2.20	2.20	1.70	26	3.02	2.92	2.70	1.95	1.90	.....
11	.....	3.20	3.38	2.20	2.20	1.70	27	2.88	3.20	2.65	1.95	1.90	.....
12	.....	3.12	3.22	2.20	2.18	1.70	28	2.78	3.25	2.65	2.00	1.90	.....
13	.....	3.05	3.10	2.20	2.10	1.65	29	.....	3.12	2.60	2.00	1.88	.....
14	.....	3.02	3.08	2.18	2.08	1.65	30	.....	3.00	2.58	2.00	1.85	.....
15	.....	3.02	3.02	2.12	2.05	1.65	31	.....	3.00	.....	2.00	.....	.....
16	.....	3.02	3.00	2.10	2.05	1.68							

Rating table for Kankakee River at Momence, Ill., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.60	310	2.10	980	2.60	2,030	3.10	3,210
1.70	410	2.20	1,170	2.70	2,260	3.20	3,460
1.80	520	2.30	1,380	2.80	2,490	3.30	3,710
1.90	650	2.40	1,590	2.90	2,730	3.40	3,970
2.00	810	2.50	1,810	3.00	2,970	3.50	4,230

NOTE.—The above table is applicable only for open-channel conditions. It is based on 9 discharge measurements made during 1905 and 1906. It is well defined between gage heights 2.1 feet and 4 feet. Below gage height 2.1 feet the table is uncertain, as the two lowest measurements are inconsistent.

Monthly discharge of Kankakee River at Momence, Ill., for 1906.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
February (21-28)	3,020	2,210	2,600
March	4,020	2,260	3,110
April	4,230	1,990	2,810
May	1,850	730	1,110
June	1,170	585	861
July (1-20)	520	360	425

NOTE.—Values for 1906 are excellent, except those for July, which are good.

YELLOW RIVER AT KNOX, IND.

This station was established August 21, 1905, and discontinued July 23, 1906. It is located on the North Heaton Street Highway Bridge, 100 rods north of the New York, Chicago, and St. Louis Railroad. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 104. The data are valuable in connection with the drainage of Kankakee Swamp.

Discharge measurements of Yellow River at Knox, Ind., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 21	M. S. Brennan	91	98	2.02	142
October 3	do	94	96	2.03	151
1906.					
March 11	E. F. Kriegsman	120	294	4.65	664
April 28	do	84	158	3.06	294
June 11	do	117	269	4.07	491
June 12	do	117	241	3.68	438
June 12	do	116	198	3.46	381
June 28	do	92	120	2.59	249

Daily gage height, in feet, of Yellow River at Knox, Ind., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Day.	Mar.	Apr.	May.	June.	July.
1	3.4	5.1	2.7	2.6	2.5	17	3.3	5.7	2.4	2.6	2.0
2	3.7	5.0	2.8	2.6	2.4	18	3.2	5.0	2.35	2.5	2.0
3	4.0	4.0	2.85	2.5	2.35	19	3.2	4.7	2.3	2.35	2.1
4	5.9	3.8	2.9	2.4	2.35	20	3.15	3.9	2.3	2.4	2.0
5	6.4	3.5	2.8	2.2	2.2	21	3.1	3.7	2.3	2.5	1.9
6	6.95	3.8	2.85	2.3	2.1	22	3.0	3.5	2.25	2.5	2.0
7	6.65	4.1	2.7	2.5	2.0	23	3.0	3.3	2.2	2.5	2.0
8	5.7	4.2	2.6	2.6	1.9	24	2.9	3.15	2.2	2.4	.....
9	5.2	4.3	2.55	3.5	1.9	25	3.0	3.0	2.2	2.3	.....
10	5.15	4.5	2.5	4.3	2.0	26	3.3	3.0	2.4	2.25	.....
11	4.65	4.9	2.5	4.5	2.1	27	4.3	3.1	2.5	2.2	.....
12	4.4	4.7	2.45	3.7	2.15	28	6.4	3.05	2.6	2.7	.....
13	4.0	4.5	2.45	3.1	2.1	29	6.1	2.9	2.7	2.6	.....
14	3.8	4.7	2.4	2.8	2.0	30	6.0	2.8	2.75	2.5	.....
15	3.5	4.8	2.4	2.7	2.0	31	5.4	.....	2.7	.....	.....
16	3.4	5.4	2.4	2.7	2.0						

Rating table for Yellow River at Knox, Ind., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	56	2.20	171	3.40	368	5.20	792
1.10	63	2.30	185	3.50	387	5.40	848
1.20	70	2.40	199	3.60	407	5.60	906
1.30	78	2.50	214	3.70	428	5.80	966
1.40	86	2.60	230	3.80	449	6.00	1,028
1.50	94	2.70	246	3.90	471	6.20	1,091
1.60	103	2.80	262	4.00	493	6.40	1,155
1.70	113	2.90	278	4.20	539	6.50	1,187
1.80	123	3.00	294	4.40	586	6.60	1,219
1.90	133	3.10	312	4.60	634	6.80	1,284
2.00	145	3.20	330	4.80	685	7.00	1,350
2.10	158	3.30	349	5.00	738		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1905–6. It is well defined between gage heights 2 feet and 5 feet. Beyond these limits the table is approximate.

Monthly discharge of Yellow River at Knox, Ind., for 1905–6.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1905.[a]			
August (21-31)	133	56	77.7
September	294	133	215
October	230	86	144
November	294	145	199
December (1-16)	387	214	320
1906.			
March	1,330	278	628
April	936	262	524
May	278	171	218
June	610	171	254
July (1-23)	214	133	157

[a] For 1905 gage heights see Water-Supply Paper No. 171.

NOTE.—Values are rated as follows: August, 1905, fair; October, 1905, good; remainder of the above period, excellent.

FOX RIVER AT SHERIDAN, ILL.

This station was established in September, 1905, and was discontinued July 20, 1906. It is located at the Glen Park highway bridge at Sheridan, Ill. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 105. The data collected are valuable for water-power purposes.

Discharge measurements of Fox River at Sheridan, Ill., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
September 19	Hanna and Brennan	199	1,020	4.05	1,100
October 31	M. S. Brennan	199	1,000	4.12	1,080
1906.					
March 11	M. S. Brennan	196	1,340	5.70	3,330
March 29	A. H. Horton	204	1,340	5.70	3,320
March 30	do	204	1,320	5.60	3,180
May 21	do	199	916	3.58	596
May 21	do	199	916	3.58	595
June 20	M. S. Brennan	198	814	3.20	387

Daily gage height, in feet, of Fox River at Sheridan, Ill., for 1906.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Day.	Feb.	Mar.	Apr.	May.	June.	July.
1		6.3	5.5	4.25	3.75	3.65	17		5.1	5.35	3.85	3.25	2.95
2		6.65	5.4	4.6	3.6	3.3	18		5.2	5.3	3.85	3.0	3.0
3		8.2	5.3	4.65	3.45	3.4	19		5.1	5.2	3.8	3.2	3.05
4		7.35	5.25	4.35	3.3	3.4	20		4.95	5.1	3.75	3.25	3.05
5		6.7	5.1	4.25	3.5	3.1	21		4.85	5.0	3.65	3.15	.....
6		6.7	5.3	4.15	3.55	3.15	22	6.8	4.5	4.95	3.85	3.05	.....
7		6.5	5.2	4.0	3.45	3.2	23	6.15	4.45	4.75	3.8	3.1	.....
8		6.45	5.15	4.2	3.35	3.05	24	6.7	4.25	4.75	4.0	3.05	.....
9		6.35	5.9	4.15	3.3	3.0	25	9.05	4.70	4.6	4.15	3.0	.....
10		6.25	6.35	4.1	3.4	3.25	26	7.6	4.85	4.55	4.0	3.0	.....
11		6.1	6.0	4.05	3.15	3.05	27	6.5	7.40	4.45	3.9	3.0	.....
12		5.8	5.75	4.0	3.2	3.0	28	6.5	6.9	4.4	3.8	3.25	.....
13		5.35	5.65	3.95	3.35	3.15	29		5.9	4.3	4.0	3.1	.....
14		5.1	5.5	3.75	3.4	3.05	30		5.6	4.2	3.95	3.65	.....
15		5.1	5.5	3.95	3.35	3.0	31		5.65	.....	3.70	.....	.....
16		4.9	5.45	3.85	3.4	2.95							

Rating table for Fox River at Sheridan, Ill., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.90	220	4.10	1,100	5.30	2,710	7.00	5,630
3.00	260	4.20	1,210	5.40	2,860	7.20	6,010
3.10	310	4.30	1,330	5.50	3,020	7.40	6,400
3.20	360	4.40	1,450	5.60	3,180	7.60	6,800
3.30	420	4.50	1,570	5.70	3,340	7.80	7,200
3.40	480	4.60	1,700	5.80	3,500	8.00	7,600
3.50	550	4.70	1,830	5.90	3,660	8.20	8,020
3.60	630	4.80	1,970	6.00	3,830	8.40	8,440
3.70	710	4.90	2,110	6.20	4,170	8.60	8,860
3.80	800	5.00	2,260	6.40	4,520	8.80	9,280
3.90	900	5.10	2,410	6.60	4,880	9.00	9,700
4.00	1,000	5.20	2,560	6.80	5,250		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1905–6. It is well defined between gage heights 3.2 feet and 5.7 feet.

Monthly discharge of Fox River at Sheridan, Ill., for 1905–6.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1905.[a]			
September (20–30)	1,050	710	831
October	1,510	420	863
November	1,210	515	912
1906.			
February (22–28)	9,780	4,080	5,770
March	8,020	1,270	3,570
April	4,430	1,210	2,540
May	1,760	670	1,020
June	755	260	422
July (1–20)	670	240	336

[a] For 1905 gage heights, see Water-Supply Paper No. 171.

NOTE.—Values are rated as follows: 1905 and March to May, 1906, excellent; February, June, and July, 1906, good.

INDEX.

A. Page.

Acknowledgments and cooperation 16
Acre-foot, definition of 4
Anoka, Minn.
  Mississippi River at:
    description 43
    discharge 43
    gage heights 44
  Rum River near:
    description 47
    discharge 47
    discharge, monthly 48
    gage heights 47-48
    rating table 48

B.

Babb, Mont.
  Kennedy Creek near:
    description 22
    discharge 22
  St. Mary River near:
    description 17
    discharge 17
    discharge, monthly 18
    gage heights 17-18
    rating table 18
  Swiftcurrent Creek near:
    description 20
    discharge 20
    discharge, monthly 22
    gage heights 21
    rating table 21
Black River at—
  Neillsville, Wis.:
    description 57
    discharge 57
    discharge, monthly 59
    gage heights 58
    rating table 58
Black River basin:
  description 56-57
  survey 57

C.

Cable station, figure showing 11
Cardston, Alberta.
  St. Mary River near:
    description 19
    discharge 19
    discharge, monthly 20
    gage heights 19
    rating table 20
Cedar Rapids, Iowa. Page.
  Cedar River at:
    description 72
    discharge 73
    discharge, monthly 74
    gage heights 73
    rating table 73
Cedar River at—
  Cedar Rapids, Iowa:
    description 72
    discharge 73
    discharge, monthly 74
    gage heights 73
    rating table 73
Channahon, Ill.
  Desplaines River near:
    description 82
    gage heights 83
Chippewa Falls, Wis.
  Chippewa River near:
    description 51
    discharge 51
    gage heights 52
Chippewa River at and near—
  Chippewa Falls, Wis.:
    description 51
    discharge 51
    gage heights 52
  Eau Claire, Wis.:
    description 52
    discharge 52
    discharge, monthly 54
    gage heights 53
    rating table 54
Chippewa River basin:
  description 50-51
Computation, methods of 13-16
Cooperation, acknowledgment of 16
Crookston, Minn.
  Red Lake River at:
    description 30
    discharge 30
    discharge, monthly 32
    gage heights 31
    rating table 31
Current meters, classes of 10
  methods of using 10-11
  plate showing 10
Crow River near—
  Dayton, Minn.:
    description 45
    discharge 45
    discharge, monthly 46

Crow River near—Continued. Page.
Dayton, Minn.—Continued.
gage heights..... 46
rating table..... 46
Crow River basin:
description..... 45
Curves (discharge, area, and velocity), figure showing..... 14

D.

Davis, Ind.
Kankakee River at:
description..... 83
discharge..... 83
discharge, monthly..... 85
gage heights..... 84
rating tables..... 84
Dayton, Minn.
Crow River near:
description..... 45
discharge..... 45
discharge, monthly..... 46
gage heights..... 46
rating table..... 46
Des Lacs River at—
Foxholm, N. Dak.:
description..... 38
discharge..... 38
discharge, monthly..... 39
gage heights..... 38
rating table..... 39
Des Moines River at—
Des Moines, Iowa:
description..... 77
discharge..... 77
discharge, monthly..... 78
gage heights..... 78
rating table..... 78
Fort Dodge, Iowa:
description..... 76
discharge..... 76
discharge, monthly..... 77
gage heights..... 76
rating table..... 77
Keosauqua, Iowa:
description..... 79
discharge..... 79
discharge, monthly..... 80
gage heights..... 79
rating table..... 80
Des Moines River basin:
description..... 76
Desplaines River near—
Channahon, Ill.:
description..... 82
gage heights..... 83
Discharge, computation of..... 13–16
Drainage basins, list of..... 2–3

E.

East Grand Forks, Minn.
Red Lake River at:
discharge..... 34
Eau Claire, Wis.
Chippewa River near:
description..... 52
discharge..... 52
Eau Claire, Wis.—Continued. Page.
Chippewa River near—Continued.
discharge, monthly..... 54
gage heights..... 53
rating table..... 54
Eau Claire River:
survey..... 60
Equivalents, table of..... 6–7

F.

Fargo, N. Dak.
Red River at:
description..... 23
discharge..... 23
discharge, monthly..... 24
gage heights..... 23–24
rating table..... 24
Fergus Falls, Minn.
Ottertail River near:
description..... 26
discharge..... 27
discharge, monthly..... 28
gage heights..... 27
rating table..... 28
Flambeau River near—
Ladysmith, Wis.:
description..... 54–55
discharge..... 55
discharge, monthly..... 56
gage heights..... 55
rating table..... 56
Flambeau River:
survey..... 56
Floats, use of, in measuring discharge..... 9–10
Fort Dodge, Iowa.
Des Moines River at:
description..... 76
discharge..... 76
discharge, monthly..... 77
gage heights..... 76
rating table..... 77
Fox River at—
Sheridan, Ill.:
description..... 87
discharge..... 87
discharge, monthly..... 88
gage heights..... 88
rating table..... 88
Foxholm, N. Dak.
Des Lacs River at:
description..... 38
discharge..... 38
discharge, monthly..... 39
gage heights..... 38
rating table..... 39
Mouse River near:
description..... 35
discharge..... 35
gage heights..... 35

G.

Gaging stations, equipment of..... 9–10
location of, map showing..... 2
Grand Forks, N. Dak.
Red River at:
description..... 25
discharge..... 25
discharge, monthly..... 26

Grand Forks, N. Dak.—Continued. Page.
Red River at—Continued.
gage heights..... 25
rating table..... 26

H.

Haggart, N. Dak.
Sheyenne River near:
description..... 28
discharge..... 28
discharge, monthly..... 30
gage heights..... 29
rating table..... 29
Hudson Bay drainage:
general features..... 16
Hydrographic surveys, organization and scope of..... 2

I.

Ice-covered streams, method of measuring flow of..... 13
Illinois River near—
Peoria, Ill.:
description..... 81
discharge..... 81
discharge, monthly..... 82
gage heights..... 81
rating table..... 82
Illinois River basin:
description of..... 80-81
Iowa City, Iowa.
Iowa River at:
description..... 71
discharge..... 71
discharge, monthly..... 72
gage heights..... 71-72
rating table..... 72
Iowa River at—
Iowa City, Iowa:
description..... 71
discharge..... 71
discharge, monthly..... 72
gage heights..... 71-72
rating table..... 72
Iowa River basin:
description of..... 71

J.

Janesville, Iowa.
Red Cedar River at:
description..... 74
discharge..... 74
discharge, monthly..... 75
gage heights..... 74-75
rating table..... 75

K.

Kankakee River at—
Davis, Ind.:
description..... 83
discharge..... 83
discharge, monthly..... 85
gage heights..... 84
rating tables..... 84
Momence, Ill.:
description..... 85

Kankakee River at—Continued. Page.
Momence, Ill.—Continued.
discharge..... 85
discharge, monthly..... 86
gage heights..... 85
rating table..... 86
Kennedy Creek at and near—
Babb, Mont.:
description..... 22
discharge..... 22
Keosauqua, Iowa.
Des Moines River at:
description..... 79
discharge..... 79
discharge, monthly..... 80
gage heights..... 79
rating table..... 80
Knox, Ind.
Yellow River at:
description..... 86
discharge..... 86
discharge, monthly..... 85
gage heights..... 86
rating table..... 86

L.

Ladysmith, Wis.
Flambeau River near:
description..... 54-55
discharge..... 55
discharge, monthly..... 56
gage heights..... 55
rating table..... 56

M.

Mankato, Minn.
Minnesota River near:
description..... 49
discharge..... 49
discharge, monthly..... 50
gage heights..... 49-50
rating table..... 50
Merrill, Wis.
Wisconsin River at:
description..... 62
discharge..... 62
discharge, monthly..... 63
gage heights..... 62
rating table..... 63
Miner's inch, definition of..... 4
Minnesota River near—
Mankato, Minn.:
description..... 49
discharge..... 49
discharge, monthly..... 50
gage heights..... 49-50
rating table..... 50
Minnesota River basin:
description of..... 49
Minot, N. Dak.
Mouse River at:
description..... 35-36
discharge..... 36
discharge, monthly..... 37
gage heights..... 36
rating tables..... 37

Page.

Mississippi River at and near—
Anoka, Minn.:
description..... 43
discharge..... 43
gage heights..... 44
St. Paul, Minn.:
discharge..... 44
Sauk Rapids, Minn.:
description..... 41
discharge..... 41
discharge, monthly..... 42-43
gage heights..... 42
rating table..... 42
Mississippi River basin:
general features..... 39-41
miscellaneous measurements..... 44
Momence, Ill.
Kankakee River at:
description..... 85
discharge..... 85
discharge, monthly..... 86
gage heights..... 85
rating table..... 86
Mouse River at and near—
Foxholm, N. Dak.:
description..... 35
discharge..... 35
gage heights..... 35
Minot, N. Dak.:
description..... 35-36
discharge..... 36
discharge, monthly..... 37
gage heights..... 36
rating tables..... 37
Mouse River basin:
description..... 34-35
Multiple-point method of measuring discharge, description of..... 11-12

N.

Necedah, Wis.
Wisconsin River near:
description..... 63
discharge, monthly..... 65
gage heights..... 64
rating table..... 64
Neche, N. Dak.
Pembina River near:
description..... 32
discharge..... 32
discharge, monthly..... 34
gage heights..... 32-33
rating table..... 33
Neillsville, Wis.
Black River at:
description..... 57
discharge..... 57
discharge, monthly..... 59
gage heights..... 58
rating table..... 58
Nelson, Ill.
Rock River near:
description..... 69
discharge..... 69
gage heights..... 70

O.

Page.

Ottertail River near—
Fergus Falls, Minn.:
description..... 26
discharge..... 27
discharge, monthly..... 28
gage heights..... 27
rating table..... 28

P.

Pembina River near—
Neche, N. Dak.:
description..... 32
discharge..... 32
discharge, monthly..... 34
gage heights..... 32-33
rating tables..... 33
Peoria, Ill.
Illinois River near:
description..... 81
discharge..... 81
discharge, monthly..... 82
gage heights..... 81
rating table..... 82
Price current meter, view of..... 10
Rating tables, construction of..... 13-15
Red Cedar River at—
Janesville, Iowa:
description..... 74
discharge..... 74
discharge, monthly..... 75
gage heights..... 74-75
rating table..... 75
Red Lake River at—
Crookston, Minn.:
description..... 30
discharge..... 30
discharge, monthly..... 32
gage heights..... 31
rating table..... 31
East Grand Forks, Minn.:
discharge..... 34
Red River at—
Fargo, N. Dak.:
description..... 23
discharge..... 23
discharge, monthly..... 24
gage heights..... 23-24
rating table..... 24
Grand Forks, N. Dak.:
description..... 25
discharge..... 25
discharge, monthly..... 26
gage heights..... 25
rating table..... 26
Red River basin:
description..... 22-23
Rhinelander, Wis.
Wisconsin River near:
description..... 60-61
discharge..... 61
gage heights..... 61

Page.
Rock River at and near—
Nelson, Ill.:
description 69
discharge 69
gage heights 70
Rockton, Ill.:
description 67
discharge 68
discharge, monthly 69
gage heights 68
rating table 68
Sterling, Ill.:
description 70
discharge 70
gage heights 70
Rock River basin:
description of 67
Rockton, Ill.
Rock River at:
description 67
discharge 68
discharge, monthly 69
gage heights 68
rating table 68
Rum River near—
Anoka, Minn.:
description 47
discharge 47
discharge, monthly 48
gage heights 47–48
rating table 48
Rum River basin:
description of 46–47
Run-off, computation of 13–16
in inches, definition of 4

S.

St. Mary River at and near—
Babb, Mont.:
description 17
discharge 17
discharge, monthly 18
gage heights 17–18
rating table 18
Cardston, Alberta:
description 19
discharge 19
discharge, monthly 20
gage heights 19
rating table 20
St. Mary River basin:
description 16–17
St. Paul, Minn.
Mississippi River at:
discharge 44
Sauk Rapids, Minn.
Mississippi River near:
description 41
discharge 41
discharge, monthly 42–43
gage heights 42
rating table 42
Second-feet per square mile, definition of ... 4
Second-foot, definition of 4
Sheridan, Ill.
Fox River at:
description 87
discharge 87

Page.
Sheridan, Ill.—Continued.
Fox River at—Continued.
discharge, monthly 88
gage heights 88
rating table 88
Sheyenne River near—
Haggart, N. Dak.:
description 28
discharge 28
discharge, monthly 30
gage heights 29
rating table 29
Single-point method of measuring discharge, description of 12
Slope method of measuring discharge, use and value of 7–8
Sterling, Ill.
Rock River at:
description 70
discharge 70
gage heights 70
Stone City, Iowa.
Wapsipinicon River at:
description 65
discharge 65
discharge, monthly 67
gage heights 66
rating table 66
Stream flow, measurement and computation of 7–13
papers on, list of 3
Surface water supply, papers on, list of 2–3
Swiftcurrent Creek near—
Babb, Mont.:
description 20
discharge 20
discharge, monthly 22
gage heights 21
rating table 21

T.

Tables, explanation and use of 4–6

U.

Upper Mississippi River drainage basin:
general features 39–41
miscellaneous measurements 44

V.

Velocity method of measuring discharge, description of 9–13
Vertical-integration method of measuring discharge, description of 12
Vertical velocity-curve method of measuring discharge, description of 11

W.

Wapsipinicon River at—
Stone City, Iowa:
description 65
discharge 65
discharge, monthly 67
gage heights 66
rating table 66
Wapsipinicon River basin:
description of 65
Water supply, surface, papers on 2–3
Weir, method of measuring discharge, requirements of 8–9

Wisconsin River at and near— Page.
Merrill, Wis.:
description..... 62
discharge..... 62
discharge, monthly..... 63
gage heights..... 62
rating table..... 63
Necedah, Wis.:
description..... 63
discharge, monthly..... 65
gage heights..... 64
rating table..... 64
Rhinelander, Wis.:
description..... 60-61
discharge..... 61

Wisconsin River at and near—Continued. Page.
Rhinelander, Wis.—Continued.
gage heights..... 61
Wisconsin River basin:
description..... 59-60
survey..... 60

Y.

Yellow River at—
Knox, Ind.:
description..... 85
discharge..... 85
discharge, monthly..... 85
gage heights..... 86
rating table..... 86

CLASSIFICATION OF THE PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

[Water-Supply Paper No. 207.]

The publications of the United States Geological Survey consist of (1) Annual Reports; (2) Monographs; (3) Professional Papers; (4) Bulletins; (5) Mineral Resources; (6) Water-Supply and Irrigation Papers; (7) Topographic Atlas of United States, folios and separate sheets thereof; (8) Geologic Atlas of United States, folios thereof. The classes numbered 2, 7, and 8 are sold at cost of publication; the others are distributed free. A circular giving complete lists can be had on application.

Most of the above publications can be obtained or consulted in the following ways:

1. A limited number are delivered to the Director of the Survey, from whom they can be obtained, free of charge (except classes 2, 7, and 8), on application.
2. A certain number are delivered to Senators and Representatives in Congress, for distribution.
3. Other copies are deposited with the Superintendent of Documents, Washington, D. C., from whom they can be had at practically cost.
4. Copies of all Government publications are furnished to the principal public libraries in the large cities throughout the United States, where they can be consulted by those interested.

The Professional Papers, Bulletins, and Water-Supply Papers treat of a variety of subjects, and the total number issued is large. They have therefore been classified into the following series: A, Economic geology; B, Descriptive geology; C, Systematic geology and paleontology; D, Petrography and mineralogy; E, Chemistry and physics; F, Geography; G, Miscellaneous; H, Forestry; I, Irrigation; J, Water storage; K, Pumping water; L, Quality of water; M, General hydrographic investigations; N, Water power; O, Underground waters; P, Hydrographic progress reports; Q, Fuels; R, Structural materials.

Series P.—The hydrographic progress reports contain the results of stream measurements. A report is issued for every calendar year, containing the results of data collected during that year. These reports were first published as a part of the Director's annual report or as a bulletin; they are now published as water-supply and irrigation papers. The following is a list, by years, of the publications containing the progress reports of stream measurements (* means out of stock). A detailed index of these reports (1888–1903) is published as Water-Supply Paper No. 119.

1888. Tenth Annual Report, Part II*.
1889. Eleventh Annual Report, Part II*.
1890. Twelfth Annual Report, Part II*.
1891. Thirteenth Annual Report, Part III*.
1892. Fourteenth Annual Report, Part II*.
1893. Bulletin No. 131*.
1894. Bulletin No. 131*; Sixteenth Annual Report, Part II*.
1895. Bulletin No. 140*.
1896. Water-Supply Paper No. 11*; Eighteenth Annual Report, Part IV*.
1897. Water-Supply Papers Nos. 15* and 16*; Nineteenth Annual Report, Part IV*.
1898. Water-Supply Papers Nos. 27* and 28*; Twentieth Annual Report, Part IV*.
1899. Water-Supply Papers Nos. 35*, 36*, 37*, 38*, and 39*; Twenty-first Annual Report, Part IV*.
1900. Water-Supply Papers Nos. 47, 48, 49, 50, 51, and 52; Twenty-second Annual Report, Part IV.
1901. East of Mississippi River, Water-Supply Papers Nos. 65* and 75*.
West of Mississippi River, Water-Supply Papers Nos. 66 and 75*.

1902. East of Mississippi River, Water-Supply Papers Nos. 82 and 83.
West of Mississippi River, Water-Supply Papers Nos. 84 and 85.
1903. East of Mississippi River, Water-Supply Papers Nos. 97 and 98.
West of Mississippi River, Water-Supply Papers Nos. 99 and 100.
1904. East of Mississippi River, Water-Supply Papers Nos. 124, 125, 126, 127, 128, and 129.
West of Mississippi River, Water-Supply Papers Nos. 130, 131, 132, 133, 134, and 135.
1905. East of Mississippi River, Water-Supply Papers Nos. 165*, 166*, 167, 168*, 169, 170, and 171.
West of Mississippi River, Water-Supply Papers Nos. 171, 172*, 173*, 174, 175*, 176, 177, and 178.
1906. East of Mississippi River, Water-Supply Papers Nos. 201, 202, 203, 204, 205, 206, and 207.
West of Mississippi River, Water-Supply Papers Nos. 207, 208, 209, 210, 211, 212, 213, and 214.

Correspondence should be addressed to

THE DIRECTOR,
UNITED STATES GEOLOGICAL SURVEY,
WASHINGTON, D. C.

OCTOBER, 1907.

O

U.S. Geological Survey

Water Supply Paper
Vols.201-207

DATE DUE	BORROWER'S NAME

IN U. S. A.

3 2044 102 944 576